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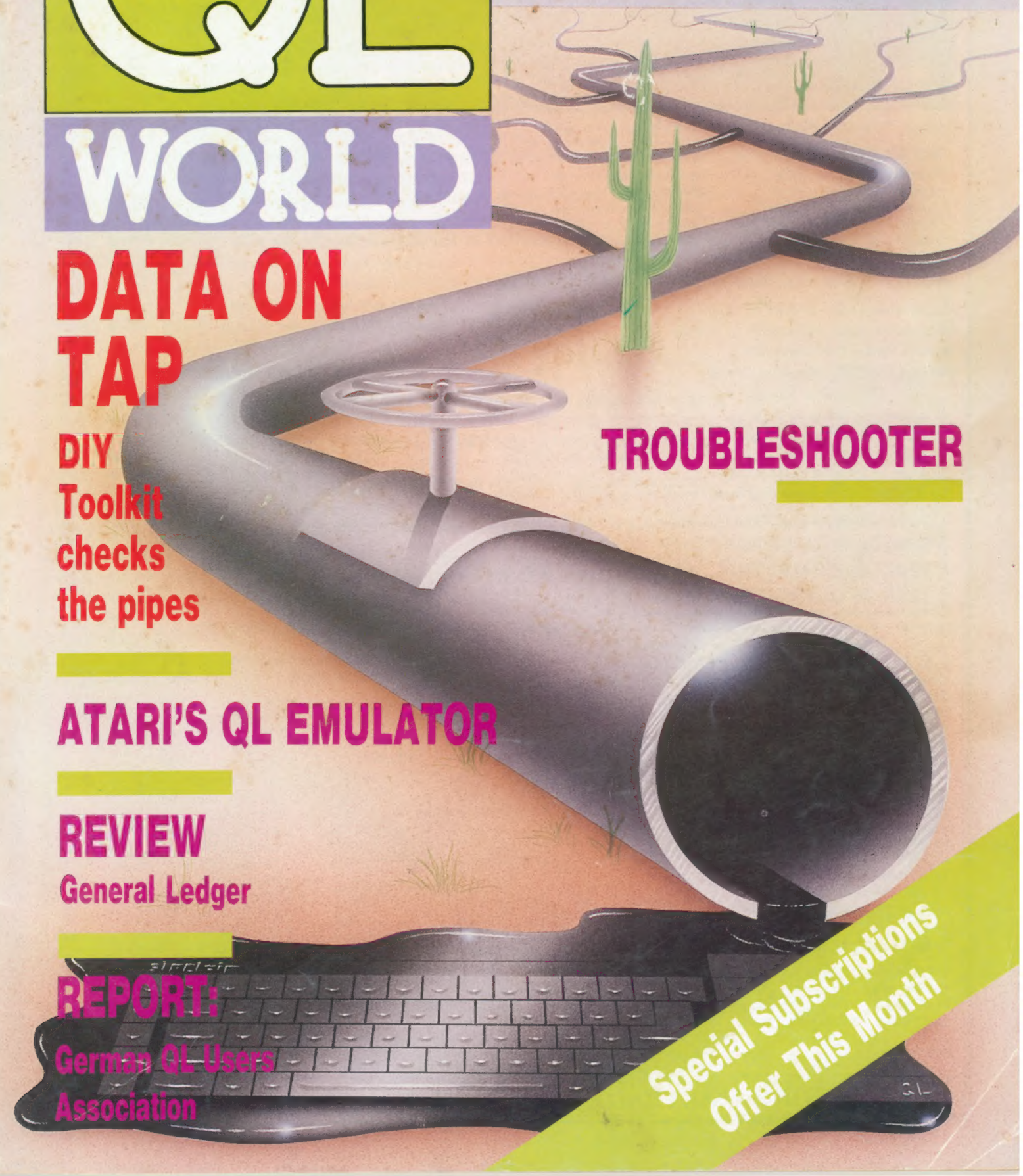

DATA ON TAP

DIY Toolkit checks the pipes

TROUBLESHOOTER

ATARI'S QL EMULATOR

REVIEW

General Ledger

REPORT:

German QL Users Association

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We regret that there is no Program of the Month this month owing to the current postal strike. QL Gold members will receive one of this month's new Microdrive Exchange titles

NEXT MONTH

Wordsearch
A puzzle generator with a difference.

The Office Revolution
One business's experience of office administration on the QL

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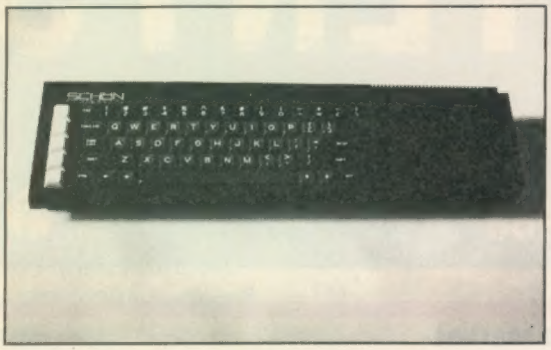

◀ SCHÖN STANDARD REPLACEMENT KEYBOARD

Schön Standard Keyboard: Still the most widely sold keyboard for the Sinclair QL. The Standard replacement has a similar key layout to the original but has proper full 4 mm travel keys. Ideal for the owner with continual membrane problems or just restricted to space. All 64 keys are two shot moulded and both microdrives and expansion ports are unaffected. New QL cover and anti-bounce device included in price. INSTALLATION: Screwdriver, no soldering – 5 minutes. Guarantee – 1 yr +. Spec sheet available.

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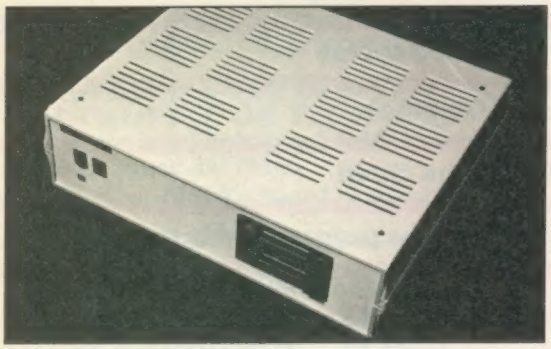

◀ SCHÖN KBL 128 QL CASING

Schön KBL 128 Computer Casing: Another high quality British product from Schön. This is a special product for the enthusiastic QL owner. Comprising of an inner metal chassis and a strong ABS outer casing it is the perfect DIY challenge to a competant QL owner who suffers from the '4 ft long problem'. The Schön KBL 128 comes complete with mounting screws and a 64 way 'flip back' cable to position expansion devices on top of the QL circuit board. There is plenty of space to include both 5.25" & 3.5" disk drives, power supplies, cooling fans, etc. Full spec sheet available upon request and plenty of telephone advice and suggestions. A highly rewarding project which works superbly in conjunction with the Schön PC keyboard. Price only £65.00 including 64 way cable, VAT, postage and packing and of course our supportive advice. Please telephone to chat about converting your QL. *(Cooling fans available if required).*

SOFTWARE – BY ULTRASOFT

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QKICK is a multi-taskiing program for the Sinclair QL which runs in the background of almost every program. Using a pull down menu structure it offers numerous facilities which can be used whilst in a major program, facilities which normally would have to be done in Superbasic. Program activation is through a 'hotkey' and upon entry numerous options are shown. Basic Program Facilities: file manipulation, disk or ram, copy, backup, rename, delete, format, start job. User accessories including, NOTEPAD, DIARY, CALENDAR, DATABASE, SCIENTITIC CALCULATOR, HEX-DEC/DEC-HEX converters. Tools include powerful HEX/DEC editor which can be used on memory, files and even disk sectors, JOB CONTROL, status display, priority change, removal etc. QKICK also includes automatic screen switch off. Please telephone or write for full spec sheet as there is too much to mention in 1 advert. QKICK is available ex-stock for £21.95 including VAT and postage.

DISKTOOL V2.10

DISKTOOL V.2.10 is another multi-tasking program which again runs in the background without interferring and can be called upon whenever necessary. It appears as a compact window which can be positioned anywhere on the screen and the icon control enables quick access to all facilites. Options include DISK COPIER (icon controlled), DISK FORMATTER (formats an extra 72 sectors per disk!!), DISK PROTECTOR (allows entry codes to be put on disks, directory shows up as blank and reads PROTECTED). Please telephone for further details. Superb transparent utility at only £9.95 including VAT and postage.

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For full program specifications see the July edition of QL World

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● Please telephone for details of other products not listed here ●

BOOKS

Using the Psion Organiser	£10	QDOS Companion	£7
Assembly lang. Programming	£9	Inside QDOS	£20
Z88 Copmputing	£10	QL Service manual	£20

Other QL titles available - phone for details -

KEYBOARDS

Schon PC	£102.00
Sandy PC	£99.00

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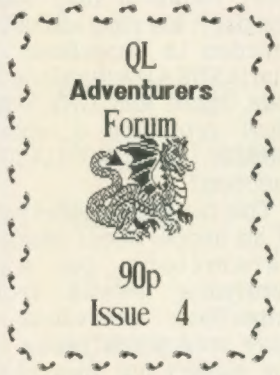
QL SCENE

Magazine adventure

QL Adventurers' Forum now arrives in the form of a readable, well-presented 24-page A4 magazine. The subscription remains £4 for four issues inclusive of postage.

The address for subscriptions and enquiries is GCH Services, Cwm Gwen Hall, Pencader, Dyfed, Cymru SA39 9HA. Tel: 055934 574.

CGH has also published an adventure, *From The Tower of Valagon* by Alan Pemberton. *QL World* has received a copy for review, but no price or availability details at present.



QLAF's front cover

Banking on QLs

DJW Software is to release its *Home Banker* package in two versions V1.2 for unexpanded QLs and V2.1 for memory-expanded QLs.

For people who want more information, DJW issues its own news bulletin, the DJW Gazette, free to anyone sending a SAE to DJW Software, 11 Pound Close, Bramley, Hampshire RG26 5BL.

Front page headlines

Gap Software is releasing some new lines updating its established desk-top publishing package *Front Page* and supporting other QL spin-offs.

Front Page Extra 3 brings a REDUCE routine to size down window contents. It can handle up to 50 percent reduction on the x-axis and y-axis individually.

For instance, a 10 percent reduction on one axis and a 40 percent reduction on the other is possible. A STIPPLE routine allows laser printer like stippling. Some simple rubber-bandable graphics routines are included.

A separate version of the package is available for the Thor/Thor XVI, which supports Winchester disc subdirectories.

The price is £44.95 for a complete new package, £25 to upgrade from the unexpanded version of Front Page, or £10 to upgrade from an earlier Extra version.

Office Manager for the Thor/Thor XVI has all the expected filehandling functions — delete, copy, and so on — including a safe format routine which checks the disc for files before formatting. *Office Manager* supports the network and fileserver. It has messaging with background receipt and storage without interrupting the current task; a diary; notepad; read any file as text, decimal or hexadecimal; copy files over the fileserver network; and other features. Winchester subdirectories are fully-supported, including remote ones on the fileservier.

Control of the program is via highlighted subdirectories, making it very easy to use. Up to 72 filenames can be displayed at a time.

The program will work on disc-based QLs with the addition of *Toolkit II* from QJump. The job-starting routine is not available in this configuration. The program also works with the Smiling Mouse but not on the Thor XVI at present. The price is £30.

Cusfile is an easy-to-use card-index database running under Archive. It is a useful program for getting into Archive. Supplied as source code, it operates from a menu by single keypress options and can be user-amended.

Cashflow is a simple spreadsheet for use with Abacus, featuring around 30 debit items and several credit items.

The two programs together cost £10.

Top Drawer is the new Smiling Mouse graphics software. It is fast and has a number of unusual features, such as pattern fill, reduce and enlarge, unusually versatile rubber-banding and pencil-style shading. To work with the Smiling Mouse only, the package costs £25, or £60 if you want the mouse as well.

The new Smiling Toolkit has more than 100 new keywords, many for graphics applications including pattern filling, pointer dumps and others. This package does not need the Smiling Mouse to operate. The price is £25.

Gap Software, 17 St John's Terrace, London E7 8BX. Tel: 01-552 5452.

Schon goes soft

Schon Keyboards has announced that it will be selling software as well as quality keyboards in the future. The first two programs, *Qkick V4.0* and *üDisktool V2.10,* are both written by Ultrasoft of Germany and are the first in a series of new packages to be released by Schon before Christmas. Both programs are multi-tasking utilities which are, says Schon, "useful additions to a software library."

When questioned more closely about the content of the programs, Schon's Chris Smith said: "It is necessary to go into a great deal of detail to pin down what they do, but both utilities are designed to be used from within a larger program. We will be putting as much detail as possible in our advertisements."

Both programs are written in machine code and are available now, costing £21.95 for Qkick and £9.95 for Disktool from Schon PCP, 15 Northcote Crescent, West Horsley, Surrey KT24 6LX. Tel: 04865 3836.

OPEN CHANNEL

Open Channel is where you have the opportunity to voice your opinions in *Sinclair QL World*. Whether you want to ask for help with a technical problem, provide somebody with the answer, or just sound off about something which bothers you, write to: Open Channel, Sinclair QL World, Greencoat House, Francis Street, London SW1P 1DG.

Ledger lines

I thought the report on General Ledger was very fair and accurate, although I have one or two comments. Firstly, the VAT bug, which only occurred with very small amounts, has been fixed. Secondly, it is our policy to develop our programs in superBASIC and to supply them in a listable form. Then, if a break should occur, it is possible to do a 'warm' restart without losing any data, hence the advice 'GOTO 100'. This is certainly not an admission that we expect the program to crash as it may have suggested. This approach also makes it possible for programs to be customised, either by the user or by ourselves, as we do offer a tailoring service at reasonable cost to suit special requirements or non-standard printers, etc. It would not be possible to maintain this level of flexibility with compiled code. Despite the much-trumpeted fool-proof error-trapping, I for one have been dumped out of such programs with regularity.

On the general subject of the QL's future now, I must say that I am encouraged by the fact that many new users are coming into the market, having bought second-hand machines at bargain prices. I can also report that people are returning to the QL fold after supposedly upgrading to Amstrad PCWs and the like. I think it would be a good idea for you to run a feature on the current alternatives, such as the Amiga and Atari ST as well as the business machines eg the PCs, MACs etc, to show what they really offer in comparison to the QL. I am sure you would stop many people defecting, because there is really nothing to touch the QL in it's price/performance ratio.

S. D. Micro Systems
Hitchin
Herts

Join Johns

You asked me to let you know how the "Club QL" is progressing. We now have members, not only from the UK but from other parts of the world. I will not go into detail, but I have been told that there are users who want to join us but do not have the address. It is:
Club QL International,
12A Wenaullt,
Dolegellau,
Gwynedd,
North Wales LL40 1PW.

Thank you for your help in the past.

W. G. Johns,
Club QL International,
Gwynedd.

Menu charge

With reference to my program *Menu* which was published recently, I have noticed a bug in it since writing it which occurs when the list of options occupies fewer than two lines, because the variable new row is not defined. It can be overcome by appending the statement "newrow = options + 1" to line 6020. The routine can be further enhanced by adding the follwing line:

6225 = 232: CLS#9:CLOSE #9:RETurn — CODE9first —let$(loop))

This returns the negative ASCII code of the first letter of the highlighted option when F1 is pressed and could be used to provide help on the desired topic.

I hope you do not think I am complaining, because I enjoy reading *QL World* every month, but I found the February edition of DIY Toolkit — file headers — a little untidy because of all the PEEKing and POKEing. Would not the routines be more usable if they were similar to the SDATE function in SuperBasic — that is SHEAD #chan length, date, space and GHEAD$# chan returning a string similar to the DATE$ function?

This could be used as part of an article about passing parameters to and returning values from SuperBasic extensions. I have read a few books on the subject but they gloss over it without explaining fully what is being done and why.

Is it possible to publish a constructional article on a low-cost Winchester disc drive interface for the QL? 5MB hard discs can be obtained very cheaply nowadays and I am sure such an interface would be of interest to many readers.

P. McMahon,
Markyate, St. Albans.

Editor's comment: As soon as somebody can show us an interface design which works well we will start planning to publish it.

Editor's notebook

We get some requests for help — usually with printers or other exotica — which can clearly only be completely answered by someone with first-hand experience. I am going to throw sticky queries open in Technical Helpline . . . any genuine solutions published in TechHelp as a direct response to an appeal in that column will be paid pro rata alongside our resident expert and his back-up team.

This may not provide "instant answers" but it will help to short-cut the lengthy process of locating the right expert for the right problem.

CST's plans to remove production of the Thor XVI to Thor International's premises in Denmark appear to have coincided with — or sparked off — a major rift within CST prorietor David Oliver's own family. News, rumours . . . call them what you will . . . are flying around like shrapnel. Everyone wants a say. We want to see the Thor rolling off the production line. Everyone who has an investment in the Thor — inside and outside the argument — should sort themselves out, get the pot boiling, or remove themselves from the kitchen.

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FOCUS MAGAZINES

UTILITY FILE

This month we present you with another batch of utility software packages

Product: Mandelbrot Quickly
Price: Disc: £24.90
Cart: £19.90
Source: Sandy (U.K.) PCP Ltd.,
Unit 33, Murdock Road,
Manton Lane,
Bedford MK41
Tel: 0234 291814

Product: Mandelbrot Magic
Price: £14.95
Source: Ultrasoft,
Vennhauser Allee 218,
4000 Dussldorf 12,
West Germany.

One of the greatest assets of the computer is its ability to manipulate complex and/or largely repetitive data. Examples of the process can be seen in spreadsheets, databases and especially in mathematically-orientated programs which produce a screen drawing as its end-product.

Specialised graphics programs can be used for every facet of entertainment and technical applications. *Mandelbrot*, like the facet programs from which it was derived, utilises mathematical calculations, signifying points, both real and imaginary.

The concept of the geometry of Nature was developed by Mandelbrot and has since found many applications in computer art and many scientific endeavours, the latter of which is most evident in various fields of biology.

Typical examples of Mandelbrot geometry can be seen throughout nature in objects such as snowflakes, plants and coastlines. Proceeding through ever-increasing magnifications, objects retain an infinite amount of detail; coastlines, with bays and inlets, become smaller bays and indentations, *ad infinitum*.

Mandelbrot, available from Ultrasoft, is menu-driven. Selecting the option for a new calculation requires the following data input:
Start Point: -3 « x « 3
Imaginary Point: -2 « y « 2
Width: 3 » width » 0
Maximum depth of iteration:
0 « iteration « 255
Are the above values correct?
Calculation type:
Fixpoint - width » 0.01
Floating point evaluation

Once input is complete, a screen message indicates that you can use «CTRL»«C» to continue with other jobs while the calculations are in progress.

Mandelbrot quickly takes a different approach to its user interface. Exceptional to the range of such programs, as the name implies ths program calculates data very fast by using the 68008 instruction "MULS" which performs a 32-bit multiplication in about 12 microseconds. Division is implemented with "ASR" — Arithmetic Shift Right. Comparative calculation time is reduced typically from 50 minutes to about 60 seconds.

Also menu-driven, values are changed by pressing the vertical cursor keys and «SPACE». Default values from the main menu are shown in the accompanying illustration.

A database — a demonstration instrution version is supplied with the program is a composite file. I liked the file-handling routine. When you call for a directory the contents from the compressed data file are listed in a window.

By pressing the left cursor key you access the directory window, allowing you to select a particular file for viewing. Two windows are opened and the drawing is reproduced in the smaller of them, with specifications of the co-ordinates used to produce the drawing in the other.

The Ultrasoft Mandelbrot takes a considerable time to complete its calculations but draws its screen very quickly, in the region of 80 seconds or so.

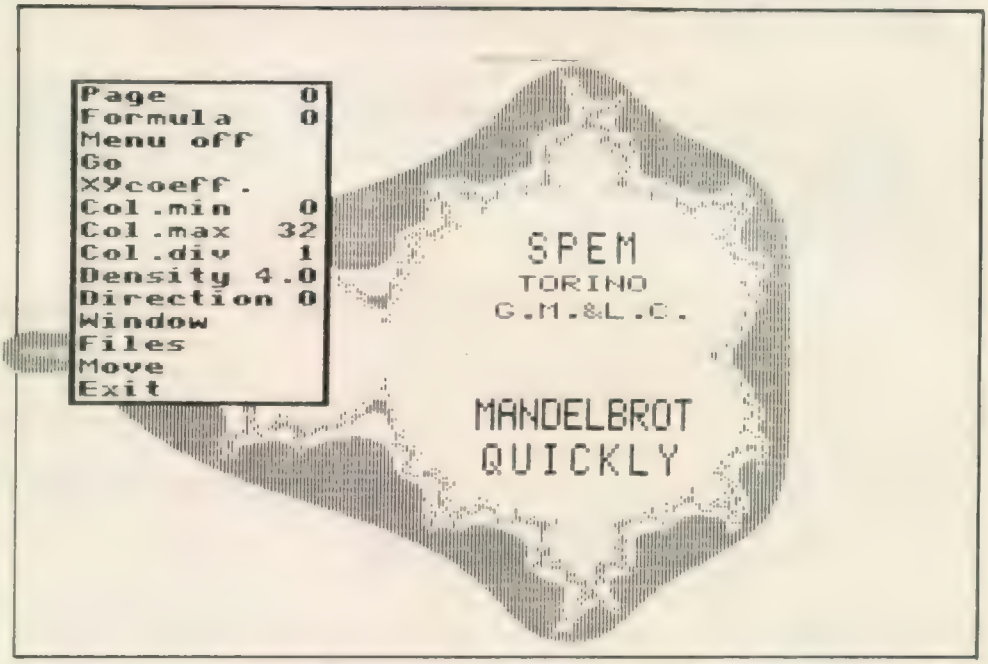
Product: Ultraprint
Source: Digital Precision,
222 The Avenue,
London E4 9SE
Tel: 01-527 5493

Ultraprint is a versatile printer dump system enabling you to produce graphic hard copy from Epson-compatible dot matrix printers in a range of sizes and print quality.

A multi-tasking program, once up and running you are offered a sequence of menu-driven options from which single keypresses are required, permitting you to modify your printed copy in terms of size, tonal values and resolution.

Screen dumps may be made using either a standard 80-column or, by selecting the larger magnification sizes, a 100-column printer from either of the two QL serial or an add-on parallel printer ports.

Two dump modes are provided — Normal, for mode 8 screens, and Special, for mode 4 screens, may be printed in monochrome as represented on the screen or



inversely similar to a photographic negative.

The next option allows you to select from a range of sizes available to each of the modes. In essence, it is a magnifying option but it is important to realise that magnification occurs with the left screen margin defining the left margin of the paper.

Selecting the size of the printed copy is determined partly by the size of the screen drawing. Where a dump of the full screen is required, the size range for an 80-column printer is restricted to sizes 1, 1b, 2 and 3 in Normal mode, and size 1 or 1b in Special mode.

After selecting the size of the copy you are offered the option of altering the default line spacing of the copy to any value between 1 and 255. For most normal applications, however, DP recommends that variation of the default values should be minimal to avoid excessive vertical distortion.

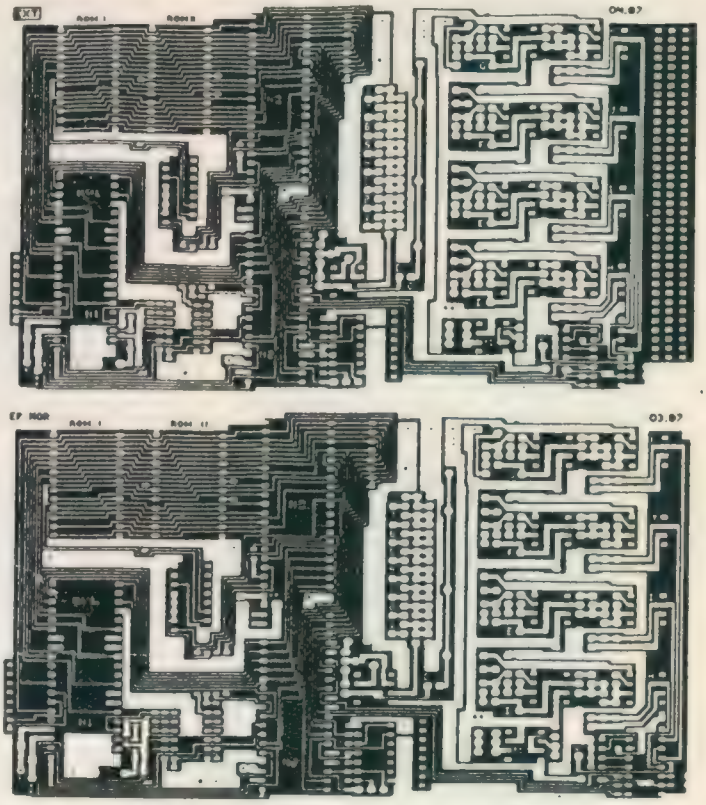
Selection is made by pressing the up cursor key to increase the line spacing, or the down cursor key to decrease the line spacing by value/216", for Epson printers, or value/144", for Oki printers.

Prints produced from the test cards I use usually for printer drivers, made in both modes, show that an increase of the line feed by 1/216" can have a pronounced effect on the amount with my Canon but could vary considerably with other Epson compatables.

The final option in the set-up sequence, controlling the density of the print copy, selects from a range of one to five passes of the printer head. Each pass overprints preceding passes of the printhead without off-setting dot registration.

Ultraprint filenames must include one of three extentions, -scr, -pcb, or -pic. When asking for a directory from a specified drive, only the files having any of these extentions will be listed. Loading a particular graphic screen is selected from a menu and, in common with other options available throughout the program, single keypresses.

When each dump is completed you are offered the option of making another dump of the same screen. If you select "Yes" the sequence of menus is re-presented; if "No", you are offered a directory of files which include the pre-requisite extentions.



● **Examples of screen dumps from the Ultraprint system**

Ultraprint was tested using my Canon PW1080A. While there is some tendency for dimensional distortion, for the majority of general graphics applications this should prove acceptable.

As can be be seen in the sample hard copy there is a dramatic difference between the Normal and Special printing modes. As one would expect, Special produced a higher-definition, somewhat smaller print.

Using the Normal mode, however, produced an effect with the black-and-white portions of the test card roughly equivalent to offset dot registration and is caused by the mathematical limitations of the QL.

Overall, Ultraprint provides a flexible means of tailoring hard copy for particular applications and is very easy to use. I feel that its greatest strength may be in the field of graphic arts.

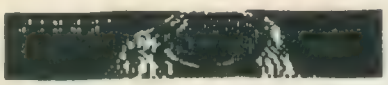
Although it purports to produce camera-ready copy from technical drawings for subjects such as printed circuit layouts, dumps made on my Canon exhibited distortion which proved uncorrectable and would result in PCBs with connection pads in the incorrect position, For manual illustration porposes, however, Ultraprint produces exceptionally good print quality.

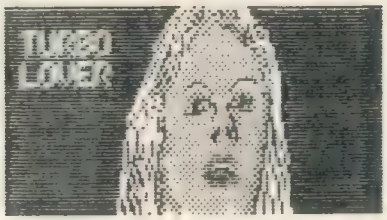
Product:	Price:
QL Spelling Tutor	£14.95
QL Maths Tutor	£14.95
QL Revisor	£14.50
QL Education Pack - all three	£37.95

Source: ESCape Software, 2 Henley Road, Ilford Essex IG1 2TT

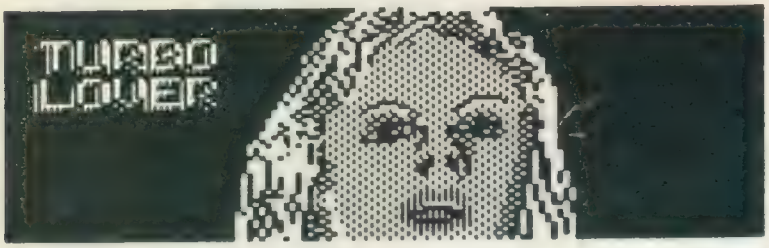
It is curious that, with the tremendous processing capabilities of the QL, so little educational software has been written for it. Paddy Software, sadly no longer trading, once provided a comprehensive range of revision software in a variety of O and A level subjects.

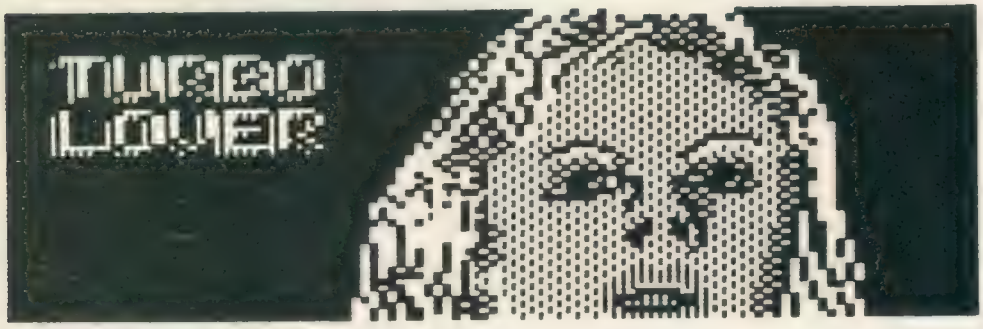
ESCape Software can now supply a range of education-





● **Different sizes are controlled using the QL function keys**





al programs, produced in-house and obtained from other sources, which should have appeal for all age groups.

Spelling Tutor, in common throughout the range available from ESCape, is a suite of routines which, produced in a games-like environment, can make learning fun. Among its repertoire is *Tutor, Hangman, Anagram, Wordsearch* and, from the *Tutor* Files option, a means of loading the extra word lists supplied with the program.

A default word list is loaded with the program, to which you can load additional word lists of particular categories such as films and physics and, by using a separate program, make many additional word lists pertinent to your interests or requirements.

Tutor provides a choice of two routines, "Copy-Me" and "Missing Letters". The former is a simple exercise of typing a word presented on-screen after it is removed from view. The latter provides a list of words

Hangman is the traditional game played by almost everyone and is therefore self-explanatory. Anagram provides you with a choice of scrambling up to four words chosen at random from the program word list.

Wordsearch is a particularly well-presented version of the standard word game which, depending on the level of difficulty chosen, can consist of up to a 16 by 16 grid from which you must find the words selected at random by the program. Words may occur horizontally, vertically or diagonally and eiher normally or reverse spelling.

A second program system available from ESCape is *Maths Tutor* which provides choices including *Nim, Hi-Lo, Mirrors, Shoot Sums* and *Fraction Tower* with a separate, particularly good game of Patience. The principal object of the program is to provide practice in basic concepts of arithmetic, geometry and logic.

The Nim screen consists of a group of icons with which you can elect to take either first or second turn. The object is select one or more icons in a row and delete them but also to avoid having to delete the last icon. I believe that the QL cheats at this game.

Hi-Lo appears to be a guessing game in which you also play the QL. The first play opens as you are asked to think of a number between one and 1,000. While the game may appear simplistic there is a certain amount of logic required in guessing the specified number by ranging the over and under estimations.

Mirrors, like Nim, is played with icons, the difference being that you are the only player.

Of all of the routines included in Maths Tutor I feel that Shoot Sums is most likely to provide the greatest amount of attraction to anyone wishing to learn or improve mathematical skills.

For one thing, its presentation is similar to a *Space Invaders* game in that you are presented with three windows, at the bottom of which is a spaceship. Mathematical problems selected at the beginning of the game for addition, subtraction, division, multiplication or a random mix are scrolled downwards towards the spaceships.

You have 10 lives and, as you type-in the correct answer to any of the three problems, the spaceship is launched and destroys the problem.

Fraction Tower is presented in a multi-tiered pagoda. A fraction is printed at the top of the pagoda and the fractions you input must be larger than the preceding fraction but also less than one.

Rounding-out its range of educational software, ESCape has included the Digitrix *Revisor*, a superb, flexible teaching framework-type program first reviewed in the February, 1987 Utility File, which has maintained a steady popularity.

The Revisor system is an invaluable aid for teachers and students. Applicable to any subject or age level, in a wide variety of tutoring formats, it can be used for learning from questions with multiple- or single-choice answers and visual teaching. Screen layouts are entirely flexible and you can design your screen layouts with windows applicable to virtually any type of application.

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The QL World Index is a complete reference to all Sinclair QL World/QL User articles compressed to fit in a standard QL.

In one second it will find any article by name, author or subject. For example; "printer" will find all references to printers from QL World or QL User. "Dillon" will find all artcles by Charles Dillon. Everything worth knowing that has appeared in QL world and QL User from its launch in June 1983 to the current issue is included. An invaluable guide for anyone who has a collection of these magazines or wants to order back issues.

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- **USER FRIENDLY** It was described as "virtually idiot proof" by a major software reviewer.

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- Create documents up to 9 pages
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Standard paragraphs can be assigned to spare keys and expanded on printout or you can simply put curly brackets at the top of your letter with the filename of a letterheading within them and when you print your letter out your logo will appear at the top. Overdrive also gives you 255 translate sequences each up to 80 characters long.

Overdrive is memory resident so does not access the microdrives at print time, unlike the Psion driver. However, Overdrive will still allow the Psion Driver to operate concurrently. Overdrive can be configured to operate on Ser1 Ser2 or both, or a separate copy can operate on each serial port independently.

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SOFTWARE

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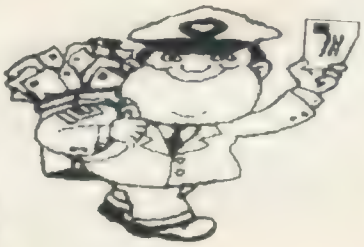

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CLUB GERMANY

Chris Smith tries to claim that this was no wild weekend

With almost five years' Sinclair experience and after visiting countless exhibitions I thought I had more or less seen a good cross-section of Sinclair owners. A Microfair is a good place to see them, a place where the Sinclair fanaticism seems to be most apparent — or so I thought.

Some time ago I received an invitation from Martin Berndt of Ultrasoft, Germany, to attend the annual meeting of the German QL Users' Association. He gave me a brief description of the event on the telephone and I said I would go. I knew that the QL had plenty of German enthusiasts but the English QL scene had struck me as being naturally more devoted. So it was time to meet them face to face and see what they were doing.

Armed with a handful of German samples, sales information, my "Sprechen sie Deutsch" EPROM in my brain, I flew to Dusseldorf. Once at Berndt's home/office we discussed the relevant QL details one usually does and then he fired-up his QL. I thought my machine took time getting to the copyright screen once powered-up but this was ridiculous.

Along with the normal F1 and F2 and so on were about a dozen other names, version numbers being displayed by all the bits and pieces he had managed to squeeze inside his little black box. Following that he guided me through his latest software achievements, which were outstanding. Not only is Berndt the chairman of the German QL Users' Association but he is also a prolific author of QL software in Germany.

The following day we arrived early at the Stadthalle, Neuss so that we could decide what to do with the hall. It was a rather plush environment to host a meeting of this kind but nobody objected. Tables and plants were moved and finally when a few QLs emerged everybody felt at home.

The event was rather unusual in that not only was there a club meeting to be held in the room but also a handful of retailers set up stands and began selling their equipment. As well as the expected box-movers there were a few club members who had taken their own computers and were demonstrating the various bits and pieces they had either built or written.

It struck me that those enthusiasts had taken it in their stride to design and produce their own ideas as if they were making a plastic model. PCB manufacturing in Europe is notoriously expensive so I was not surprised when I saw a fully-functioning wire-wrapped hard disc interface which had been built by a young man and many other prototypes had been built using primitive but affective methods.

I was amazed when I discovered that people were producing their own PCBs using photocopiers and microwave ovens. People were buying blank EPROM cards as if there was no tomorrow.

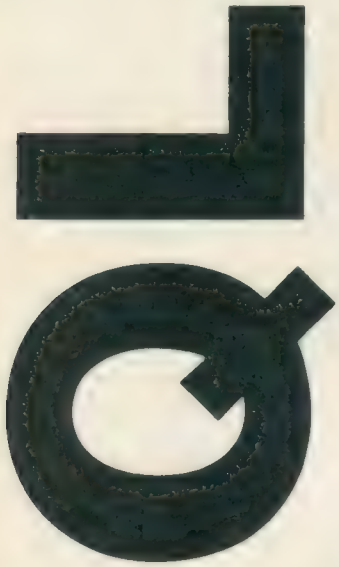
Seeing all this at first hand re-assured me that the QL is far from dead. It was fantastic to see and meet all those enthusiastic QL owners and to be able to discuss with them what they want to see the British do for the QL; I must say they had plenty of ideas.

Throughout the day I noticed that the hall contained two main groups of members, those who were interested in the debate and final vote for a new chairman and those who were not. After a few hours I understood that the members could not decide on a new chairman. The main board attempted the vote a few times and finally became resigned to having a postal ballot. All this, I thought, for a QL User group. Berndt went to the meeting as chairman and left the meeting as chairman.

On the whole, the weekend was a good experience and I have opened a few doors so that some of the brilliant German soft/hardware can be shared by eager British users.

QL EMU

Ron Massey puts the QL onto an Atari with a new program.



Few computer enthusiasts will argue against the statement that QL SuperBasic is the best implementation of Basic yet devised. Other features, often absent on more expensive machines for which the QL has been well-endowed, is its native genuine multi-tasking, networking and fileserving facilities. Other machines which offer similar options usually do so at considerable extra cost.

The features offered by the QL operating system Qdos are built into its ROM. The majority of other current micros rely on using one or more utilities for accessing I/O devices such as the screen, printer or storage drives. Loading an operating system on start-up is far more common with the majority of machines. The main advantage of this approach is that upgrading a system is easier and less expensive.

In common with most other micros, the QL, with the proper kind of software, can mimic an alien operating system. Mimicry of another environment is called emulation. The process of emulation makes one computer think that it is another machine and a good emulator will allow you to use most of the software available for the alien machine on the host, provided it is not also hardware-dependent, i.e., requiring specialised chips for dedicated functions.

The Sandy *CPMulator* and Digital Precision *Success* are both implementations of CP/M emulation on the QL. Currently in the middle stages of development, another emulator for synthesising a different operating system is promised for delivery soon.

One of the main problems with emulation arises where the host machine — in this case the QL — does not have the hardware available to perform particulare tasks. Limitations of this kind make running operating systems such as that of the Amiga, with its host of specialised chips for sound, graphics and colour, virtually impossible.

Another problem inhibiting emulation arises where, lacking the intended hardware or where hardware is utilised in a manner divergent from the QL method of working — disc access is one of the most common problems — a means of simulating the alien hardware must be found.

Most software suppliers try to provide programs which will work with all QL configurations, whether a standard 128K machine only with Microdrives or fully-expanded machines. That the QL CP/M emulators have supported this concept is evidenced by their ability to read and write CP/M files on to Microdrives and that is a very alien environment for a DOS to meet.

Sideways

In many ways, the emulation of an operating system is a sideways development. The advantage of emulation is that users have effectively two or more computers in a single machine.

What about putting the QL operating system Qdos on to other machines? One of the biggest problems encountered is that much of the internal QL workings are largely QL-specific. Emulating the QL requires the consideration of three broad areas of QL design — the keyboard driver, the non-standard display and the integral Microdrive system. Since other machines are not likely to have any provision for Microdrives, effective error-trapping for program references to Microdrives must be considered.

Designing a QL emulator requires certain considerations for mimicing the multi-tasking system. Multi-tasking considerations can be broken into four broad categories, all of which are managed by Qdos:

Memory allocation; each task requires its own workspace.

Time-sharing; each task is assigned processing time in multiples of 20mS.

Keyboard management; for user-defined connection to specified tasks.

I/O device management; shared responsibility between Qdos and a device driver to ensure that devices — output ports, storage devices — operate without conflict.

The Welsh-based firm Strong Computers has released the first emulator which enables you to have most of the many features of the QL on two other 68000-based machines, the Atari ST and the Atari Mega. The Strong QL/Atari emulator was developed originally by the Norwegian firm Futura Data Centre — no relation to the QL derivative — for its own communications system and has since been refined for commercial release.

Direct type-in

The complete emulator kit consists of the hardware adaptor, an Atari-formatted disc containing the relevant files for switching the ST into QL mode and a QL-formatted disc containing a routine which will extract the QL ROM and transfer Qdos from your QL to a previously Atari-formatted disc.

The emulator hardware consists of a small printed circuit board on which is mounted the displaced Atari Shifter chip, a QL 8301 ULA and several surface-mounted TTL chips. Installation of the emulator card requires that all of the Atari internal metal shielding be removed. Connection to the ST is made with only seven wires but two connections to the Atari GLUE chip must be modified to allow software to switch the Atari into QL mode.

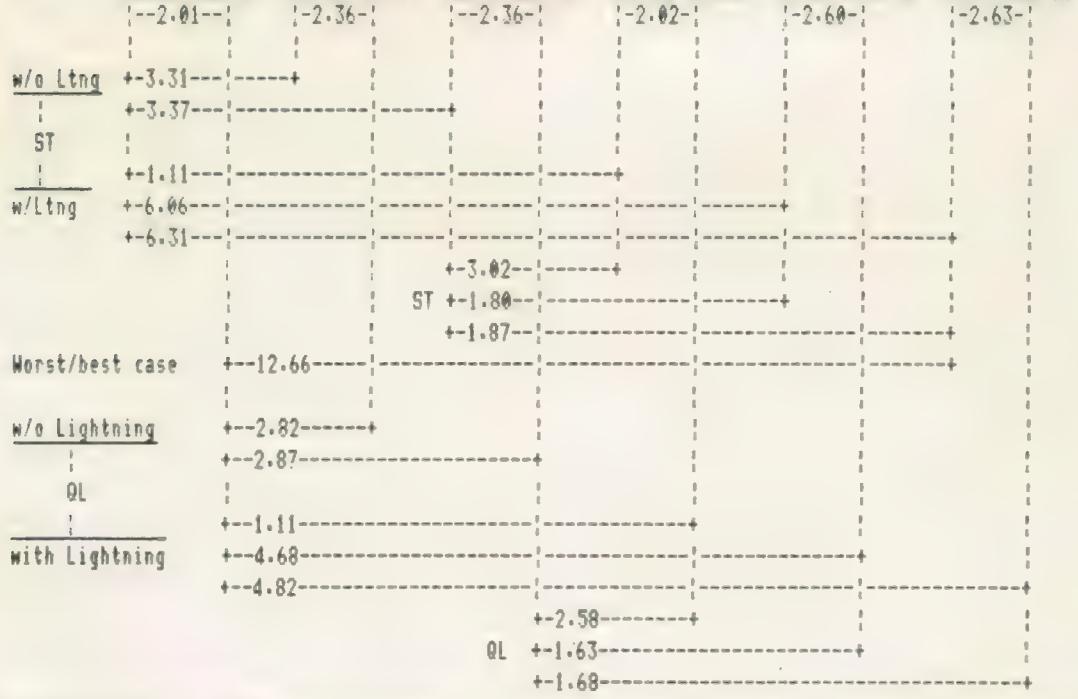
A QL-compatable Atari may be obtained in either of two ways. You have the option of buying a modified Atari with the upgrade kit installed or you can have your Atari upgraded by Strong Computers.

From the user's point of view there is one important difference between the QL and the Atari; the QL interpreter enables you to type-in commands directly. The Amiga also makes provision for this option, although a utility — the CLI — must be loaded first. Neither Atari provides native facilities for inputting commands directly from the keyboard.

Starting the emulator could not be simpler. On switch-on or re-set, have the Qdos/Atari disc in drive A. After the relevant files are loaded you are presented with the familiar QL copyright screen. Put the application you wish to

LATOR

	WITHOUT LIGHTNING						WITH LIGHTNING					
	BASIC		TURBO		OPTIMISED		BASIC		TURBO		OPTIMISED	
Loop	ST	QL	ST	QL	ST	QL	ST	QL	ST	QL	ST	QL
1	35	70	11	26	11	25	31	64	6	16	5	15
2	37	73	11	25	11	25	33	66	6	15	6	15
3	36	73	11	26	10	26	32	65	6	16	6	15
4	36	73	11	26	11	25	33	66	6	15	6	15
5	36	72	10	26	11	25	32	65	6	16	5	15
6	36	73	11	25	11	26	33	66	6	15	6	15
7	37	73	11	26	10	25	32	65	6	15	6	15
8	36	72	11	26	11	25	33	66	6	16	6	15
9	36	73	11	25	11	25	32	65	6	15	6	15
10	36	73	11	25	11	26	33	65	6	16	5	15
Time	361.55	725.35	109.26	257.6	107.21	253.05	324.28	653.45	59.69	154.94	57.3	150.59



Left: benchmark readings obtained with the Strong Computers QL/Atari Emulator on a program running under the interpreter (in Basic) and compiled.

run in drive A and press <F1>.

QL programs running on an Atari is an interesting combination. The emulated environment can give you several advantages. The Atari acquires a real multi-tasking system, albeit by a rather roundabout route. Second, QL programs work significantly faster. Quill, on the ST, is really impressive.

A basic 1040 ST, in QL emulation mode, offers about 810K of usable memory. SDL supplies a RAM card for the ST which will expand the ST memory by another 2MB. The emulator running in the Mega can have more than 3.5MB of memory on a fully-expanded machine.

Arguments concerning computer speed have always been popular. Unfortunately, benchmark tests are often taken as definitive indication of computer prowess. This usually leads to erroneous conclusions. The following bench tests indicate the improvements experienced with the emulator provided for review, figure one. The tests were carried-out with the same Basic program, running under the interpreter — in Basic — compiled with *Turbo* and compiling with Turbo optimising for speed. Two identical tests were run, without and with DP *Lightning*.

Improvement in speed depended entirely on what was being accom-

Right: the program used to obtain the benchmark times above.

```
 90  REMark IMPLICIT% y,z :  REMark If compiled.
100 CLS
110 INPUT "Press <ENTER> to start....",q$
120 AT 0,0 : CLS 3
130 DIM a$(1000)
140  t1=DATE
150 FOR y=0 TO 9
160   d1=DATE
170   a$=""
180     FOR z=1 TO 1000
190       a$=a$&"x"
200       AT 0,0:PRINT y&'  ',z&'   '
210     END FOR z
220   d2=DATE
230   IF y<9 : AT y+1,2 : PRINT y+1!!d2-d1
240   IF y>=9 : AT y+1,1 : PRINT y+1!!d2-d1
250 END FOR y
260 t2=DATE
270 PRINT\ TO 5,t2-t1
280 PRINT\ " Over ";
290 FOR i=1 TO 18 : BEEP 200,2 : PRINT'*'; : PAUSE 3
    : END FOR i
```

plished. Generally, speed improvements varied between 1.1 to 12.7 times. As a proof of QL compatability, the Basic listing, following the bench tests, was compiled with Turbo using the ST and this report was prepared in Quill running inside the Sector *Taskmaster,* all on the ST.

The figures in figure one were obtained with the following listing. The Turbo complied version is without optmisation. The optimised version of the compilation is for Structor code @ < 64K and front-end set to FAST.

Two in one

The comparisions in figure two were made using version 2.05 of The Editor and 2.3 Quill on the ST and the QL, with and without Lightning.

Without putting too fine a point on it, QL programs operating on the ST are a dynamic combination.

If what you are seeking is a go-quickly QL at a moderate to middle range price, there can be little doubt that the Strong QL/Atari emulator is a valuable addition to the continuance of QL design philosophy. At £199, one might consider the upgrade a little expensive but having two machines in a single package has much to commend it.

One of the principal advantages of running QL software on the Atari is that the Atari hardware is generally better than that of the QL and you have the ability of utilising greater memory expansion than is easily possible with the QL. Another advantage of the QL emulator is that you have the option of running all the normal Atari software as well.

While reviewing the emulator I tried several QL programs considered as industry standards in the world of the QL such as Taskmaster, the Psion suite, The Editor, the QJump *QRAM* system and a variety of other similar programs, all of which ran satisfactorily on the ST.

The emulator works only with the MODE 4 colour range. Entering "MODE 8" will switch to the QL low resolution but you will still have only four colours with which to work. As the majority of serious programs are intended for use in the QL high-resolution mode, this is not likely to prove to be a great hardship for the majority of users.

The lack of the integral Toolkit II, supplied with most of the better QL disc interfaces, was overcome by loading TK II extensions as software from the QJump re-configurable version of TK II. Provided certain precautions were observed, disc access was reliable.

If you are using the re-configurable version of Toolkit II, be sure to select the default PROG, DATA and DESTINATION drive options. If you fail to make provision for having default drives and input "DIR" without specifying a drive number — as TK II normally allows you to do — into the QL/Atari, expecting the drive to default to, say, drive one, you could have both, causing the emulator to hang up and possible corrupting your disc as well.

QUILL
Document: 615 lines of standard text.

		Without Lightning		With Lightning	
Machine	Doc Load	Scroll Top to Bottom	GOTO Top to Bottom	Scroll Top to Scroll	GOTO Top to Bottom
QL	17.2	229.9	2.92	157.5	1.96
ST	8.8	82.0	0.98	54.2	0.80
Improvement	1.95x	2.80x	2.98x	2.91x	2.45x

THE EDITOR
Document: 1643 lines.

	Without Lightning		With Lightning	
Machine	Scroll Top to Bottom	GOTO Top to Bottom	Scroll Top to Scroll	GOTO Top to Bottom
QL	257.25	1.34	117.3	0.84
ST	104.71	0.49	66.2	0.29
Improvement	2.46x	2.73x	1.77x	2.90x

Above: Speed comparisons using Quill and The Editor.

Although the Atari can print through either its serial or parallel port, the usual printer connection is to the Atari parallel port. When opening a channel to the printer you should use SER rather than the more logical PAR.

As one might expect, there are a few snags. The emulator is definitely not a DIY upgrade. For one thing, there are about a dozen versions of ST main circuit board, making explicit installation instructions difficult. This would not be so bad in itself but the components on each version of the motherboards are assigned different part numbers.

QL Copyright

Second, you should own a QL to meet copyright requirements for copying the ROM from your machine for use with the emulator. If your QL is not disc-based it has been suggested that Strong Computers may consider offering a service which, if you send your QL, it would copy the ROM from your machine and return it and the relevant files on an Atari-formatted disc for a small fee.

QL programs running on the ST should avoid particular references to QL-specific features. While "mdv" is recognised by the emulator it invariably caused the system to hang up which is no use at all. Disc errors, such as changing a disc or attempting to write to a write-protected disc, normally well-managed on the QL, can corrupt a disc on the ST completely.

Tony Tebby of QJump found one incompatibility in the ST emulator which means that some QL software may require revisions to run on the ST. Address 0 is special on the ST; on the QL it contains 0.

The potential for future developments of the QL/Atari combination is an open book. The version of the emulator supplied for review was a prototype and exhibited several of the teething problems from which any new system at this stage of development can suffer. Being aware of the possible pitfalls made working around them fairly easy.

There is tremendous potential for developing the current implementation of the QL/Atari combination by interested parties in a succession of possible future upgrades. As just one area for consideration, it is conceivable that the Atari hardware, which produced very good sound and graphics eventually, could be linked into the emulated SuperBasic, making the Atari into a kind of high-speed Super QL.

Working backwards, it is also conceivable that a ROM-based system for the emulator, developed as a Qdos look-alike, could be put on to EPROM for the QL as its own ultimate upgrade; new features intended for the Atari hardware would be ignored when operated in the QL.

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TROUBLE

APROBL

This month, Bryan Davis shows us, among other things, how Flashback can break down barriers.

There are various reasons why some users do not take advantage of the facilities Archive offers. One of them is that it is necessary to understand and make use of the programming language which is associated with the program. Another is that the speed with which information can be recalled is not always sufficient for the desired application.

The program *Flashback* circumvents both of these objections and is well worth considering for database applications in general. There is no programming language to bother about, entry and editing of data is simple — as easy as using Quill — and the speed of searches for data is really surprising.

Using it on a name and address file of 267 records and a German dictionary file of 1,427 records I found that searches for groups of characters produced almost instantaneous response, in all cases. Both files are normally used with run-time Archive, which gives instant response — using the Locate function, if a full field is typed-in but takes a few seconds when only part of a field is entered — the Find function. Worse still, when the character group entered is searched for several times in succession — using Locate, followed by Find and Continue — as when looking for several people with the same name — it can take more than 10 seconds for the program to make it known that it cannot find another occurrence of the group.

While a smart programmer might find ways of improving Archive response in such situations there is no need to look for them with Flashback; it is fast enough. A very useful feature of Flashback is the ability it has to take existing Archive —dbf files and convert them to —dba files for its use; the process is simple and does not take too long.

If you have reason subsequently to alter the layout of records it can be done in a similar manner to editing a Quill file. The converted files are likely to be smaller than the original —dbf ones; my dictionary file dropped from 113K to 98K. The memory requirement should also be less; the Flashback file is about 16K smaller than Archive but only about 2K smaller than Run-time Archive and you do not need to allocate a fixed amount of data space and RAM disc space, as I do using Archive with a switching program.

You have to expect to lose something, of course, and lack of a programming language and the ability to write your procedures restricts the amount of tailoring you can do. I use procedures in Archive to back-up the RAM database file at intervals but only if changes have been made to it and I can also swap database files with the back-up procedure taking place automatically first but Flashback permits both reading and writing of files, so there is no great loss. A certain amount of additional keying may be required but the gain in speed should make this acceptable.

The rigid format of commercial software has, until recently, led to users thinking in terms of one-job programs. You have had word processor, database, spreadsheet and business graphics in separate packages and the best for which you could hope was the facility to interchange data between some of the programs, in a rather ponderous procedure involving converting files, copying them to a drive, then importing them.

Handles data

The time taken often exceeds that required to re-type the data into the other program. Flashback is an example of a program which breaks down some of those barriers — it handles data rather like a word processor, it permits fast access to any of the data as a good database does, and you can order data.

The other program I have found to be a never-ending source of new ways of doing jobs is *The Editor*. It is something which can grow on you through the years, especially as it has so far had new features added every few months. Some readers' letters suggest too much is expected of the existing Psion programs and too little thought is given to alternative ways of doing things. Given the need to combine text with ordered numeric information, Editor allows you to enter the numeric information into the text file an as it comes sequence, then to sequence specified blocks of that data numerically, taking into account the data in certain columns only.

The best way to try to make this clear is an example and I have had a succession of similar ones recently. They have been spare parts lists for electrical appliances; there are a variety of parts number formats, prices and descriptions and they do not apply to all models of each range. The parts numbers and descriptions were all typed-in in the form supplied, unordered, then ordered on the middle five columns of the numbers to enable prices to be added — the price lists are ordered primarily on those five columns — and ordered subsequently on the last five columns, to correspond with the way they are identified on parts breakdown drawings.

Model names

A further action is to add the appropriate model names to indicate which parts are used on which models and that has to be done step by step, as model data is obtained from several separate documents. Putting the model names at the end of a line allows a variation of the normal Find/Exchange procedures to be used, where groups of characters can be looked for only at the ends of lines and exchanges made there as models are added to the list.

Doing such a job with Quill would be a real pain, even if Abacus were called on to assist. Such jobs are only one step in a chain which leads to a printed result — service manuals in this case — but there is no reason why Editor should not be used for on-line databases as well. The Find facilities are comprehensive and fast in operation. If you need to move blocks of text around, laterally as well as up and down, the new Block Move command is easy to use and can act on blocks of characters, columns or lines, rather like the cut-and-paste operation in desk-top publishing and graphics programs.

The regular Microfairs in London attract many visitors and, although QL suppliers sometimes say the effort of attending is not worthwhile, I am sure QL users who visit them feel they are important. This is of only academic interest to people who live far from London. One supplier points out that the time involved in a trip to a fair from the Midlands is scarcely worth the effort. He asks if there is sufficient interest to suggest similar fairs being held further north. Birmingham would seem the obvious location, because of its geographical position and relatively easy access by train and road.

Having spent almost six hours on the road getting to and from the Which Computer? Show at the NEC, I am inclined to give that show a miss next year but would

SHOOTER

EMSOLVED

still go if there were some QL attraction nearby at the same time.

Perhaps the major factor in the fairs is the support of Spectrum users, as the majority of visitors are to be seen around the Spectrum-only stands. Another idea from the same source is videos on the use of software packages. Video demonstrations of products are a standard feature of shows such as the Which Computer? Show. Can we hope for some at future Microfairs?

R. A. Mellor is experiencing problems running the programme *Froggy*, since he has fitted a Trump Card to his QL. Is there any advice from the program author Tony Day, or Miracle Systems?

Mellor hopes that 1988 will "see an end to the copyright problems preventing a new ROM being brought out." Some readers will know that the ability to produce an improved version of Qdos is available but the attitude of Amstrad, as the buyer of the QL rights, is such as to make it rather risky to sell ROMs which are based on the original Qdos. The threat of lawsuits is real enough, apparently, to keep such projects on the back burner. Does anyone have any more up-to-date information on the situation?

J. Camps Oliver has written previously from Spain. His first query has been dealt with subsequently with by the supplier concerned. The latest request was for assistance in obtaining Microdrive cartridges, ordered from Q Parts in April and May last year and not received as of September last, despite a reminder in July. As several months have elapsed since the reader wrote to *QL World*, the goods may have been despatched by now but a response from the supplier to my January letter would be appreciated.

Profitable business

No doubt other people have had difficulty obtaining cartridges and one reason is that the sources of cheap cartridges have largely dried up in the last six months, leaving some suppliers with orders which they may not be able to fill at the original prices. I have found that the cost to me has gone up from 70 pence to £1.50 each, in quantities of 10. Allowing for the fact that there may be some poor cartridges in large batches this is a high price for about 100K of storage space. Buy disc drives.

J. R. Christy had difficulty with a copy of *Desktop Publisher*, purchased from Digital Precision, and complained about always having to speak to an answering machine when he called. DP responded within two days to my request for comment and stated that the matter had been dealt with and that has now been confirmed by Christy. The delay was because he contacted the office at the start of a holiday period. The problem was associated with the boot file and only affected copies of the program sold at the previous Microfair and used subsequently on JM ROM machines.

C. Roger Fernando also had occasion to contact DP during the holidays. If he still has a problem using *Super Media Manager* on his system, I would appreciate further comments from him. The problem appeared to be related to the interface he uses with his QL; the MCS interface was not supplied with the Tony Tebby Toolkit built into it and SMM required certain Toolkit commands to be present to perform disc access functions. Apart from SMM not working with the MCS interface there can be problems when swapping discs between systems, if the other system uses a "standard" interface i.e., one with the TT Toolkit — most interfaces, in fact.

Files can become inaccessible because of apparent corruption of the disc directory. Apparently I was mistaken in thinking that a replacement EPROM can be obbtained now for the MCS interface incorporating the TT Toolkit but it is possible Tebby could produce one on request. Bear in mind, however, that one-off requests of this nature are not profitable business and the charge might seen rather high.

Suppliers have an obligation to deal with complaints within 28 days. That is a fairly long period and I think most complaints are dealt with in less than that time, but obviously it is rather difficult to ensure response within one or two weeks at certain times such as holiday periods.

T. V. Hargie wishes to convert his Taxan 12in. colour monitor so that he can receive TV transmission on it. This type of conversion has been offered in the past but I do not know of anyone providing the service now. Any suggestions? The obvious thought is that the cost of such a modification is likely to be similar to that of buying a TV set.

Sven Weber in the Orkneys bought 5¼in. disc drives from D. S. Enterprises in June last year and had to return them as they did not appear to work. Since then he has heard nothing from D. S. As reported in a previous issue, D.S. has not been contactable for some months and I do not have much hope of Weber seeing his drives again. Any news of this supplier will be reported. Readers who wrote about Pyramide (Rio Promotions) should try contacting the original address and tlephone number again. The company is apparantly still in Pyramide to Transform International. The latter company is supplying some of the same programs and has made improvements but can obviously not accept responsibility for dealing with any complaints which concern Rio.

Interpreter required

Stuart Tirsun wrote a detailed letter in answer to the request for help on Pascal from **M. Zavadsky.** Tirsun has three versions of Pascal for the QL — those for Prospero, Computer 1 (Compware) and UCSD (TDI). He suggests using the Computer 1 version as it is user-friendly and suited to beginners and simple projects. It can be used from RAM disc. As Compware is still active in the QL business, you can also expect support for the product.

For more advanced work he recommends the Prospero ProPascal system which has all the features of ISO Pascal. It has the GST linker, allowing combination of Pascal with other languages in the same program and it can be multi-tasked. Another possibility is the Metacomco Pascal which includes an editor program, although you might find The Editor from Digital Precision more useful.

UCSD Pascal is different, requiring an interpreter for each particular computer, since it was designed for use on a computer which was not in existence. This version does not conform to the ISO standard fully, as it was written before that standard. As the supplier, TDI, has gone from the QL scene, the only source Tirsun can suggest at present is Philgerma but the cost is more than £100 and you need to deal in German with the supplier.

INFORMATION

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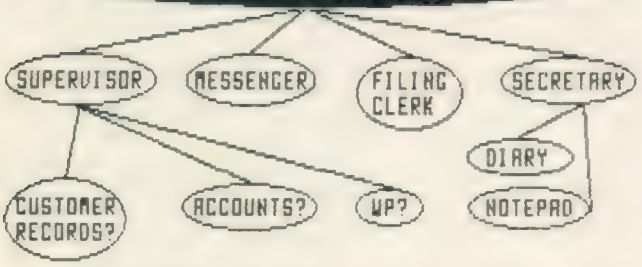

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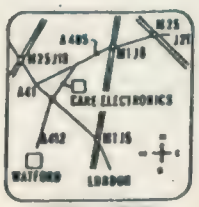

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TECHNICAL HELPLINE

Paul Walton looks at linking a Spectrum to the QL, a Brother to the QL, and the mysterious Cyclic Redundancy Error.

Spectrum files

C. Hicks of Chiswick writes: Is there any way in which Tasword 2 *Spectrum files can be transferred to* Special Editor *on the QL? Taking the question a step further, can I transfer text files from a Spectrum Basic program for use with a QL Basic program?*

There are two problems — the hardware link between the two machines and the software control of the transfer. The obvious way to connect the two machines is through an RS232 link between ser1 on the QL and an interface 1 unit on the Spectrum and basically print files from Spectrum to QL.

So, first, the hardware connection. Use a standard QL serial lead; remove the 25 D-pin connector. Replace it with the 9-pin D connector required to fit Interface 1 on the Spectrum and make the connections as shown in figure one.

So far as the transfer of Tasword files is concerned, the simplest way is to "print" them to the interface as if they were going to a printer. This leaves only the problem of receiving the text at the QL end and saving it to a file. Figure two shows a listing to do this. When you can see the transfer is complete, break the program and type "CLOSE #5".

The Special Editor program can then be used to edit the files as plain text. Your text files on the Spectrum can be transferred by writing a Spectrum program, similar to figure two, to read the file at the Spectrum end and print it to the serial port.

Figure 1.

Wire Colour	9 Pin Connector
Green	pin 2
White	pin 3
Red	pin 4
Blue	pin 5
Black	pin 7

Figure 2.

```
100 INPUT "Enter file name: ";
    fname$
110 OPEN_NEW #5, fname$
120 OPEN #4, ser1
130 REPeat transfer
140   INPUT #4, one_line$
150   PRINT one_line$
160   PRINT #5, one_line$
170 END REPeat transfer
```

Code stall

R. Fowles of Liverpool is having difficulty, making a Brother daisywheel printer work. He writes; Although I have tried a variety of codes to install the printer, none seems to have the desired effect. Is it possible that the connecting cable is not wired to suit the QL?

You indicate that the Brother is set to a baud rate of 300 with odd parity. So to set ser1 to the same conditions and print to it you could use:

```
OPEN #5, ser1oc
BAUD 300
PRINT #5, "Hello Brother"
```

If this has no effect and yet the Brother self-test works, the problem is presumably in the cable or the QL. The easiest way to check the QL is to try it on another printer which is known to work.

You do not say what model the Brother is but if it is the cable wiring most Brother machines need the serial connections shown in figure one.

Be careful when joining the 4, 5, 6, 8 pins at the Brother end as these connections must not touch the other pins, especially pin 7.

Disc check

S. Hurwitz of Cirencester writes: Occasionally my QL throws up the message CYCLIC REDUNDANCY ERROR. No-one seems to have heard of it. Have you?

I have heard of it but not on the QL. I assume that you have a disc-based system because this error message usually is associated with the transfer of data to and from disc.

Cyclic Redundancy Checking is a method of adding extra bits to data being transferred so that its correctness can be verified at the receiving end. A similar technique of which you may have heard is the use of a parity bit; a 7-bit data code is padded with an eighth bit set to one or nought to make the total number of 1s even. The receiving device can then check the evenness of the count to see if an error has occurred in transmission.

Such a check is not infallible. Another major limitation is that, even when the check reveals an error, it cannot reveal which bit is at fault. CRC is a more sophisticated method which adds several extra bits to enable the receiving device to detect an error and also to correct it. The method can detect more than one error but it is still possible for multiple bit errors to be unresolvable.

Even if the error message were only a warning that a correction had been made, it could indicate a head alignment problem or poor-quality discs. You may be in danger of corrupting your files. Have the drive head alignment checked and/or use quality branded discs.

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DIY TOOLKIT

Simon Goodwin opens access to pipes on any QL, in interpreted or compiled Basic.

There is a little-known device built into every QL, the pipe. Pipes are temproary buffers for information but they work like hardware devices. Programs can PRINT information into a pipe channel and read it back later with INPUT. Functions like INKEY$ and EOF also work with pipes; once a pipe is open it can be treated like any other character device.

Pipes are fast; they can read or write about 10,000 characters a second. They were designed to allow communication between tasks but they are also useful in independent SuperBasic programs.

Unfortunately there is no way to use pipes on a standard QL. The code to handle them is in the ROM and you can open a pipe for output but you cannot read back data because there is no SuperBasic command to open an input pipe.

DIY Toolkit comes to the rescue, giving you full access to pipes on any QL, in interpreted or compiled Basic. Four new routines are introduced and explained.

The first routine is a procedure, QLINK, which can appear in a program or as a command. QLINK takes an output pipe channel and a new channel number and links the two channels so you can read values from the new channel after they have been written to the output pipe.

You open a pipe for output much like any other channel. After the device name you put the capacity of the pipe, in characters; it can be any value between 1 and 32,767. For instance, this opens a 2K pipe:

```
OPEN #4, PIPE-2048
```

Once you have opened a pipe channel you can print characters to it. The characters vanish until the pipe is full, when the system waits for something to take out characters. You need a new command, QLINK, to do this in SuperBasic.

QLINK connects an output pipe to a new channel, from which you can read the information in the pipe. The first thing put into the pipe is the first to come out, as you might expect. This program illustrates QLINK, although it is rather a long-winded way of saying hello to yourself:

```
10  OPEN #5,PIPE-30
20  PRINT #5,"Hello ";
30  QLINK #5 TO #4
40  INPUT "Type your name "; A$
50  PRINT #5,A$:CLOSE #5
60  INPUT #4,B$:PRINT B$
70  CLOSE #4
```

Listing one shows how you can use QLINK to do more interesting things in SuperBasic.

Closing the output channel puts an 'end of file' marker in the pipe. It is important to close both ends of the pipe when you have finished, or the memory reserved for its contents will not be reclaimed. The operating system uses about 100 bytes to store channel details, in addition to the 'queue' used to store characters. All this memory is released once both ends of a pipe are closed.

If you fill a pipe you cannot, put in more characters until some are taken out, so that space can be re-used. In SuperBasic, as usual, you can get out of this situation by pressing Control Space, which stops output prematurely. The new pipe functions introduced later make it easy to avoid this problem.

There is no check on the separators used with QLINK, so you can type QLINK 5, 4, or QLINK #5 TO #4 or even QLINK 5!4; the only important things are the values and their order. As usual you can use variables or calculations instead of numbers if you wish.

QLINK does not contain code to expand the channel table to accommodate channels which have never been used previously. That would take a good deal of code, because there is no safe way to access the Sinclair expansion routine. This means that the second, input, channel number must be equal to or lower than the higest channel number you have used so far, or you will get a 'channel not open' error.

The easiest way to ensure this is to open the output pipe using a high channel number and then use a lower number for the input pipe when you QLINK it.

Compiled

Compiled programs use static channel tables, so they do not run into this problem. It is best to keep channel numbers in the range 0-15, to suit compilers and to save memory when programs are interpreted. The SuperBasic channel table uses 40 bytes for each channel number up to the maximum, whether you use it or not. OPEN #500,PIPE-15 works, but uses about 20K of memory which would still be available if you used OPEN #5 instead.

The most common problem when using QLINK is getting the input and output pipes muddled. This usually gives a 'bad parameter' error, for

```
start     lea.l   define,a1
          move.w  $110,a2         BP.INIT vector
          jmp     (a2)
*
define    dc.w    1             One procedure
          dc.w    qlink-*
          dc.b    5,'QLINK'
          ds.w    0
          dc.w    0,3           Three functions
          dc.w    qspace-*
          dc.b    7,'QSPACE%'
          ds.w    0
          dc.w    qsize-*
          dc.b    6,'QSIZE%'
          ds.w    0
          dc.w    qcount-*
          dc.b    7,'QCOUNT%'
          ds.w    0
          dc.w    0             End of functions
*
pipe_name dc.w    6             Input pipe name string
          dc.b    'PIPE_0'
*
qlink     move.w  $112,a2       Vector to get integers
          jsr     (a2)          CA.GTINT
          bne.s   bad_exit
          subq.w  #2,d3         Check for two channels
          bne.s   bad_param
          bsr.s   get_channel
          bmi.s   not_open
          addq.l  #2,a1         Discard first integer
          move.l  d3,d5         Save first channel ID
*
* Process second channel No. & close channel if need be
*
          bsr.s   get_channel
          bmi.s   closed
          move.l  d3,a0
          moveq   #2,d0         IO.CLOSE
          trap    #2
*
* Connect input channel to existing pipe
*
closed    moveq   #-1,d1        Owner is this task
          move.l  d5,d3         Output pipe ID
          lea.l   pipe_name,a0
          moveq   #1,d0         IO.OPEN
          trap    #2
          tst.l   d0            Did the OPEN fail?
          bmi.s   bad_exit
          move.l  a0,0(a6,d7.l) Store channel ID
          rts                   Return no error
*
* Check channel number: set D3 to ID and D7 to offset
*
get_channel move.w  0(a1,a6.l),d7  Get BASIC channel No.
          mulu    #40,d7        Channel table size
          add.l   $34(a6),d7    Add base offset
          cmp.l   $34(a6),d7
          bge.s   what_chan     Past end of table?
          move.l  0(a6,d7.l),d3 Grab channel ID
          rts
*
what_chan addq.l  #4,a7         Return to old caller
not_open  moveq   #-6,d0        Error, Channel not open
          rts
bad_param moveq   #-15,d0       Error, Bad parameter
bad_exit  rts
*
qspace    moveq   #-1,d5        D5<0 for QSPACE%
          bra.s   get_param
qsize     moveq   #0,d5         D5=0 for QSIZE%
          bra.s   get_param
qcount    moveq   #1,d5         D5>0 for QCOUNT%
*
get_param move.w  $112,a2       Vector to get integers
          jsr     (a2)          CA.GTINT
          bne.s   bad_exit
          subq.w  #1,d3         Check there's only one
          bne.s   bad_param
          bsr.s   get_channel   Locate channel
          bmi.s   not_open      Channel must be open
*
          moveq   #0,d0         MT.INF to find queue
          trap    #1            Find system variables
          move.l  120(a0),a0    Base of QDOS channels
          lsl.w   #2,d3         Convert D3.W to offset
          move.l  0(a0,d3.w),a0 Base of channel details
          move.l  24(a0),d0     Check input queue base
          beq.s   try_output    It's zero, try output
          bmi.s   bad_param     Not a pipe!
          tst.l   28(a0)        Check output is closed
          bne.s   bad_param     Not a pipe!
          bra.s   got_queue
*
try_output move.l  28(a0),d0    Try output queue base
          ble.s   bad_param     Not a pipe!
got_queue btst    #0,d0         Queue base must be even
          bne.s   bad_param     Not a pipe!
          move.l  d0,a2         Assume it's a queue
*
* Compute total space available in D7
*
          move.l  4(a2),d7      Get end pointer
          lea.l   17(a2),a3     Point 1 beyond start
          sub.l   a3,d7         D7 is queue size
          tst.l   d5            For QSIZE% the
          beq.s   return_int    result is in D7
*
          move.w  222,a0        IO.QTEST vector
          jsr     (a0)
*
* Ignore EOF and NOT COMPLETE (i.e. empty) reports
*
          tst.l   d5
          bpl.s   find_used
          move.l  d2,d7         Return QSPACE%
          bra.s   return_int
find_used sub.l   d2,d7         Return QCOUNT%
*
return_int move.w  d7,0(a1,a6.l) Put result in space
          moveq   #3,d4         Indicate type is INT
          moveq   #0,d0         No error
          rts
*
          end
```

Listing one: four new routines are introduced.

instance if you try to write to the input end of the pipe.

This month's kit includes functions which let you interrogate pipes, from either end, to find their capacity and contents. The functions were developed for use with Quickfax, a new QL database which makes extensive use of pipes but they are equally useful in other programs.

All the functions return integer values between 0 and 32,767, the maximum capacity of a pipe. They have one parameter, the number of a channel currently in use for pipe input or output.

Checks in the code should cause an error report if you try to use the functions on a channel which is not a pipe. It is possible that some 'freak' channels might slip through the net

DIY TOOLKIT

when they should really be rejected. In this case the functions may return strange values but your program will not crash.

QSIZE% tells you the maximum capacity of a pipe, in characters. This matches the value specified when the pipe was opened for output. QSIZE% allows a task expecting input from a pipe to check the maximum length of data it can expect.

When PRINTing to a pipe, remember that an invisible end-of-line marker, CHR$(10), is written after each line of printing, unless you put a separator at the end of the PRINT command. INPUT needs the marker to tell it where each line ends. You must use INKEY$, or similar functions, to read data that is not split into lines.

QCOUNT% returns the number of characters which have been written to a pipe but not yet read from it. QSPACE% returns the number of unused character spaces in a pipe.

The functions have been written to work reliably on any QL-compatible computer, including CST Thor and Thor XVI. They are ofen particularly useful in compiled tasks. They work on all QL pipes, including ones created by multi-tasking commands like EX in Super Toolkit or Turbo Toolkit EXECUTE.

All this month's routine names start with 'Q', as they work on 'queues' in the QL memory. Queues are circular buffers — areas of memory manipulated via two pointers. One pointer says where new characters are to be put and another says from where they are to be taken.

Queues

Queues de-couple programs, which process data, from the hardware which collects or transmits it. Queues are used all through the QL — for keyboard input, network and serial data transfer.

The Thor XVI uses queues to pass messages between its two processors. Thor queues are held in an 8K area of memory shared between the processors, which makes communication much faster than on the QL.

Sinclair machines transfer data bit by bit through a serial link, slowing things and tying up both processors as messages are transferred. If you want to see what happens when this links gets out of step, try pressing CTRL, ALT and 7 simultaneously but save your work first.

The QL pipe driver was implemented very quickly and makes heavy use of existing routines in the ROM. The while device driver is 56 lines of machine code. The code for the pipe routines is listed in two forms. Listing one is the source text, assembled using the HiSoft *DevPac*. You can type this text into your own assembler if you want to customise the code or play with it to see how it work.

Listing 2 provides a quick way to enter the code without using an assembler. It loads the equivalent machine code from DATA statements and saves it in a file. The first part of listing two is Marcus Jeffrey's hex loader, used in each month's DIY Toolkit project. Only the DATA, from line 590 onwards, changes from month to month.

When you RUN listing two it checks the data and prints a message if you have made a typing mistake. If all is well it asks you to enter the device and file-name and creates a concise code file, which you can load like this:

```
base-RESPR(268):LBYTES  "file name",base:CALL base
```

Once you have typed these commands you can use QLINK, QCOUNT%, QSIZE% and QSPACE% in you programs. You must load the code file before loading Basic programs which use the new keybwords.

As usual, the START routine calls BP.INIT, the ROM vector which adds new commands to SuperBasic. The table labelled DEFINE indicates that one procedure and three functions are to be added and gives their names and addresses.

First, QLINK reads its parameters. Both are integer channel numbers, so it calls CA.GTINT to fetch them. GTINT returns with a non-zero value in D0, signifying a 'bad parameter' or 'error in expression' if it cannot find suitable values.

Maths stack

The number of integers found is returned in D3 and the values appear on the 'Maths stack', addressed by (A1,A6.L). If it does not find two values QLINK reports a 'bad parameter'.

GET-CHANNEL takes a channel number from the maths stack and uses it to find the address offset of the SuperBasic table entry for that channel and hence the 'channel ID'

```
100 REMark Columnar CATalogue command v 0.4
110 REMark Copyright Simon N Goodwin 11/8/88
120 :
130 DEFine PROCedure CAT(cols%)
140   LOCal max_chars%,col_width%,name$(36),drive$(5)
145 :
150   IF cols%<1 : PRINT #0;"Bad CAT parameter" : STOP
160   drive$="flp1_"
170   OPEN #4,pipe_4000
180   DIR #4,drive$
190   QLINK #4 TO #3
200   CLOSE #4 : REMark Mark end of file
205 :
210   REMark Compute maximum number of characters per line
220   max_chars%=CHAN_W%(#1,28) DIV CHAN_W%(#1,38)
230   REMark Allow for 2 character gap between columns
240   max_chars%=max_chars%+2*(1-cols%)
250   col_width%=max_chars% DIV cols%
260   IF col_width%<2 : PRINT #0;"Bad CAT parameter" : STOP
265 :
270   col%=0 : REMark Column numbers are 0 to (cols%-1)
280   REPeat tab
290     IF EOF(#3):EXIT tab
300     INPUT #3,name$
310     IF col%=0 : PRINT : ELSE PRINT "  ";
320     IF LEN(name$)>=col_width%
330       PRINT name$(1 TO col_width%);
340     ELSE
350       PRINT name$;FILL$(" ",col_width%-LEN(name$));
360     END IF
365     col%=(col%+1) MOD cols%
380   END REPeat tab
390   CLOSE #3
400 END DEFine
```

Listing three: CAT uses QLINK in a stand-alone program.

the system uses to identify it . A 'channel not open' error occurs if the channel table is not big enough.

On return from GET-CHANNEL the 'negative' flag is set if the channel is not open. We can rely on this because the last data value fetched was D3, the channel identifier, and that is always negative for closed channels. The first QLINK channel must be open; we complain if it is not.

The next two lines discard the first channel number, so that the second is at the top of the stack, and code the first channel identifier to D5 for safe-keeping. GET-CHANNEL is called again to process the second number. This time we expect the channel to be closed; if it is not we close it and continue.

The last part of QLINK, from CLOSED onwards, calls IO.OPEN to allow input from the pipe indentified by D3. If it is not a pipe identifier the system returns an error code. Otherwise we plug the input channel identifier into the channel table for SuperBasic to use in future.

As in May, much of the function code is shared. When differences are required the program checks D5, used as an indicator or 'flag' to record which result is required. D5 is chosen because it is rarely corrupted by the operating system, so the value survives even if subsequent code makes heavy use of QDOS.

GTINT and GET-CHANNEL are again used to read and check the parameter. The Qdos call MTJNF finds the system variables and the Qdos channel table, distinct from the SuperBasic one.

The word value of the channel identifier gives us the position of a pointer in the table. The pointer is the address of the channel details, which includes the address of the 'queue' used to hold pipe data.

This access method is not so neat or compatible as SD.EXTOP, used in May, but EXTOP works only with console channels. Luckily, pipes are handled consistently by all QL versions, so the 'magic number' offsets of 24 and 28 should always work.

The functions check that only one queue pointer is in use; if more than one pointer appears to be set this cannot be a pipe channel. Queues always start on an even address, as they begin with a long word value, so we must check that the base is even, or an 'odd address' error could crash the system.

There is no explicit check that the channel number you indicate corresponds to a pipe, because Qdos will not let extensions ask a channel its type; it is meant not to matter. It matters a great deal if you want to make the best possible use of devices.

My *ad hoc* checks reject most invalid channels and subsequent code is designed so you do no harm by reading values from the incorrect channel. The maximum length of a pipe can be determined from the queue header, documented in Andy Pennell's *Sinclair Qdos Companion* and other books about the QL operating system. The second long word in the header points to the end of the queue, which starts immediately after the fourth long word.

One byte of space is never used to simplify Sinclair code, so QSIZE% is calculated by subtracting the end address from the address 17 bytes — 4 long words + 1 — after the start of the header.

QSPACE% uses the vectored utility IO.QTEST to determine the number of free bytes in a queue.QCOUNT% is calculated from QSIZE%-QSPACE%.

At RETURN-INT the result is slotted into the stack space previously occupied by the channel number and passed back to SuperBasic.

Listing three demonstrates one use for QLINK in a stand-alone program. CAT is an improved version of the normal DIR command. When you type DIR a list of file-names appears on the screen. Each name is on a line of its own, which means that the list

Listing two: The hex loader and data.

```
100 REMark Sinclair QL World HEX LOADER
110 REMark by Marcus Jeffery & Simon N Goodwin
120 :
130 CLS
150 RESTORE : READ space : start = RESPR(space)
160 PRINT "Loading Hex..." : HEX_LOAD start
170 INPUT "Save to file...";f$
180 SBYTES f$,start,byte : STOP
190 :
200 DEFine FuNction DECIMAL(x)
210 REturn CODE(h$(x))-48-7*(h$(x)>"9")
220 END DEFine DECIMAL
230 :
240 DEFine PROCedure HEX_LOAD(start)
250 byte = 0 : checksum = 0
260 REPeat load_hex_digits
270    READ h$
280    IF h$="*" : EXIT load_hex_digits
290    IF LEN(h$) MOD 2
300       PRINT"Odd number of hex digits in: ";h$
310       STOP
320    END IF
330    FOR b = 1 TO LEN(h$) STEP 2
340       hb = DECIMAL(b) : lb = DECIMAL(b+1)
350       IF hb<0 OR hb>15 OR lb<0 OR lb>15
360          PRINT"Illegal hex digit in: ";h$
370          STOP
380       END IF
390       POKE start+byte,16*hb+lb
400       checksum = checksum + 16*hb + lb
410       byte = byte + 1
420    END FOR b
430 END REPeat load_hex_digits
440 READ check
450 IF check <> checksum
460    PRINT"Checksum incorrect. Recheck data."
470    STOP
480 ELSE
490    PRINT"Checksum is correct"
500    PRINT"Data entered at: ";start
510 END IF
520 END DEFine HEX_LOAD
530 :
540 REMark Space requirements for the machine code
550 DATA 268
560 :
570 REMark Machine code data
580 DATA "43FA000A34790000","01104ED200010034"
590 DATA "05514C494E4B0000","000300B007515350"
600 DATA "41434525007A0651","53495A4525000074"
610 DATA "0751434F554E5425","0000000650495045"
620 DATA "5F303479000000112","4E92664C55436646"
630 DATA "61266B3E54892A03","611E6B0620437002"
640 DATA "4E4272FF260541FA","FFD270014E424AB0"
650 DATA "6B262D8878004E75","3E31E800CEFC002B"
660 DATA "DEAE0030BEAE0034","6C06263678004E75"
670 DATA "588F70FA4E7570F1","4E757AFF60067A00"
680 DATA "60027A0134790000","01124E9266EA5343"
690 DATA "66E461C46BDC7000","4E4120680078E54B"
700 DATA "2070300020280018","670A6BCA4AA8001C"
710 DATA "66C4600620280018","6FBC0800000066B6"
720 DATA "24402E2A000447EA","00119E8B4A856712"
730 DATA "3079000000DE4E90","4A856A042E026002"
740 DATA "9E823387E8007803","70004E75","*",20358
```

DIY TOOLKIT

soon scrolls off the top of the screen and does not use the full width of most windows.

CAT formats the output of DIR into neat columns across the screen, using the full width of the window and avoiding needless scrolling. You can still pause output by pressing CTRL-F5, as normal. CAT requires one parameter — the number of columns to be displayed. CAT 1 gives results just like a normal DIR, except that excess characters are chopped from the end of long names printed in narrow windows. CAT 2 gives two columns and so on.

CAT can cope with any number of columns so long as it is left with at least two characters of space between columns and room for two or more characters of each name. You can change these limits by substituting other values for the '2' in lines 240 and 260 respectively.

You get the message 'Bad CAT parameter' if you ask for less than one column or more than will fit in the default window. CAT uses the DIY Toolkit channel functions to find the number of characters which can be printed in a window. You do not have to change the program whenever you move the window or change MODE, BORDER or CSIZE.

Line 220 uses CHAN-W% to determine the width of the window, in characters. The code for this function was listed in the May *QL World*. If you do not have the code you must replace line 220 with an assignment statement to suit your normal window set-up. For instance:

```
220 max-chars% = 68
```

would be suitable if you normally use TV windows in MODE 4 with no border and CSIZE 0,0. You will need to change this if you adjust the window, whereas the version using CHAN-W% adapts automatically.

CAT is just a start. You may like to add a heading, showing the date and device name. If your directories become very full you will find the channel functions useful when formatting the directory display into separate pages.

As written, CAT works with only one drive, pre-set in line 160. It always directs output to the default channel, SuperBasic channel 1. You could add extra parameters to circumvent this, giving a command like:

```
CAT "FLP2—" TO #3, 4
```

This might send a four-column directory of floppy disc drive 2 to channel 3. What about optional parameters and name parameters as recognised by the Sinclair machine code DIR command? You cannot handle them with normal SuperBasic or existing toolkit functions.

● *Next month will extend the QL language to give interpreted Basic the same flexible parameter handling you can use in machine code.*

Since REPLACE was printed I have had several requests for more information about the inner workings of SuperBasic, so I plan to explore the core of that system, the Name List and Name Table, in next issue. If you would like me to explore a specific area in this column, or implement new commands, particularly ones unavailable in commercial toolkits, please send your suggestions.

SOFT FILE

Andrew Shephard has it figured

Software: General Ledger
Supplier: SD Microsystems. PO Box 24. Hitchin, Hertfordshire.
Tel: 0462 675106
Price: £19.95 (14.95 if purchased with *Traders Pack*) inc. VAT postage and packing.

Hard on the heels of its updated *Small Traders Pack*, SD Microsystems has produced a new *General Ledger* package. This sets out to replace the tedium of paper book-keeping with a flexible but easy-to-use keyboard accounting system. The software aims to produce accurate accounts in formats likely to satisfy the accountant and the taxman. There are no more columns of figures to add, no more end-of-the-year panic to get matters in order.

The package presents a friendly face even to those who find the subject of accounts boring and frustrating. The accompanying notes are easy to follow and sample data is included on the cartridge to enable the novice user to experiment before risking real data. Better still, try a complete dummy run and discover if the package will serve your particular needs.

Think long and hard about account codes and plan the frequency of your accounting periods — which under this package can be as short or long as you like, though there is a limit of about 250 entries per data file. There is a facility for aggregating separate files to bring together a whole year's accounts.

As befits an accounts package there is nothing exciting about the screen displays but they are clear throughout. The package works on expanded and unexpanded QLs and is at home on a disc with the addition of an 'flp—use mdv' to the beginning of the boot file. Menus take you through the package and operations happen crisply. Having altered the account codes to suit your circumstances — and you must remember to save any changes which are made — you are ready to enter some data. When the data entry option is selected, your codes are listed in the left-hand window. This is useful when deciding which category to allocate to different receipts and cheque stubs as you enter all transactions. There is no need to worry about entering transactions in the correct date order because option eight on the main menu will juggle things round for you.

Care is needed in inputting data since, in keeping with accounting practice, transactions cannot be erased — only balanced by a negative entry. My one criticism is that you cannot abort an entry part-way through when you realise you have made a mistake — you have to complete the entry and then press 'N' when asked to confirm. The same tendency occurs throughout the package.

The true value of the software is shown when, having made a few entries, you can test the summaries, ledgers, VAT accounts and profit and loss situation. To have this kind of information at the touch of a button or two is a real delight — though the manual warns against extremes of elation or depression at the profit and loss account. Beware of drawing too many conclusions from short-term data.

The package assumes the use of a dot matrix printer for hard copy and I use a daisywheel. This manual warns that breaks may occur but that 'GOTO 100' will get you out of trouble and back to the main menu. This lack of polish is explained by a desire to keep the program short and not too memory-greedy.

At a modest price, the package offers the prospect of saving hours of tedious work and is an encouragement to good book-keeping practices.

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SUPER BASIC

Mike Lloyd links extra procedures to his lists

The theory of linked list data structures explained last month introduced an example of a linked list with a suite of procedures. This month the range of activities which can be associated with linked lists is examined and additional procedures are listed and explained.

A linked list, like all other data structures, is a way of storing information in the computer memory so that it can be accessed by *data management* routines. Particular data structures favour certain kinds of applications and the choice of structure usually depends on what is to be done with the information once it is in store.

A *stack* is useful when information is retrieved in Last-In-First-Out order. Using a stack as a keyboard buffer results in text being printed-out backwards. To manage a First-In-First-Out situation like a keyboard buffer a *queue* would be adopted.

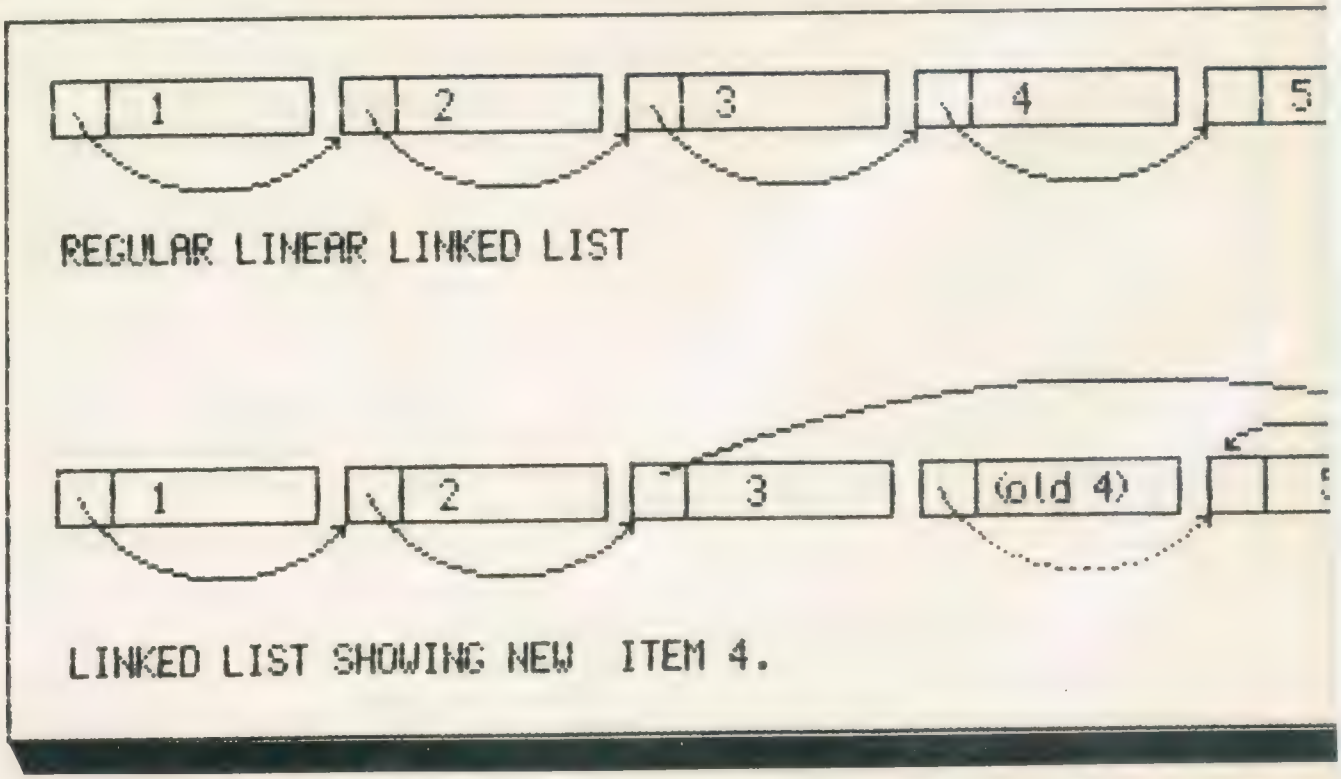
Stacks and queues never re-order the elements placed in them, so to allow sorting a different data structure, usually of the static variety,

"Either half of the key alone is not sufficient to produce an exceptional match . . . only by combining the two can a specific data element be described."

must be chosen. Coping with the volatile world of binary trees and digraphs found in programs such as *Psion Chess* demands more complex and fluid data structures. Much of the current research into artificial intelligence is centred on the twin pillars of a new high-level programming language and new data structure.

Linked lists can be used as queues, stacks, deques — which are half-stack and half-queue structures — arrays, trees or digraphs. They can also form unusual structures such as our example. Arrays are not half so versatile, even though they are easier to handle, are found in all Basic dialects and require little programming skill.

There are 10 activities performed commonly on data lists, although not all may be implemented on any particular application. They are appending a value to the end of a list; inserting a value elsewhere in a list; reading a value; deleting a value; moving the logical location of a value; combining a number of lists into one; splitting a list into many lists; counting the elements in a list; sorting a list into order; searching a list for a particular value.



Not all those processes have been implemented on the accompanying linked list suite but sufficient examples have been coded to allow readers to develop comprehensive suites of their own.

Last month's article showed how the data area was established and how list elements were appended to existing data. The final procedure printed-out the contents of a chosen list to a given destination.

Accounting

The first of this month's procedures prints-out all the data held in the reserved area in the order in which it was entered. This facility would be useful where many individual data sets combine to form a total data set, such as in last month's example of the various classes of yachts in the Fastnet race.

On a different tack, accounting programs allocate inputs to different accounts but the order in which they were entered needs to be preserved for auditing purposes. In either example, the ability of a data item to belong to two data sequences simulataneously is extremely useful, because it reduces the storage space required by the data and it also speeds data retrieval.

Listing seven requires only the one parameter, the reference value of a previously-opened channel. To find the address of the first element the total number of lists needs to be retrieved from SysVar #1. Each list header takes six bytes and the global system variables also occupy six bytes, so a simple multiplication and addition reveals the start of the data area proper.

Listing 7

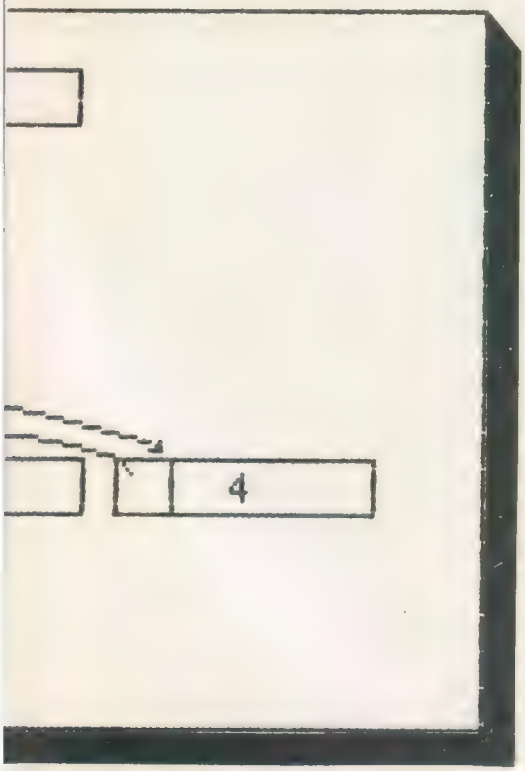
```
700 DEFine PROCedure PrintAll (chan)
705 LOCal loop, x, Byte
710 Byte = LinkBase +PEEK_W (SysVar (1)) *6 +6
715 REPeat loop
720       IF PEEK_W (Byte) = 0: EXIT loop
725       FOR x = 4 TO PEEK_W (Byte) -1
730           PRINT#chan; CHR$ (PEEK (Byte +x));
735       END FOR x
740       PRINT#chan
745       Byte = Byte +PEEK_W (Byte)
750 END REPeat loop
755 END DEFine Print_All
```

Listing 8

```
800 DEFine PROCedure FindPosn (posn, link)
805 LOCal x, Byte
810 IF Wrong_Link (link): STOP
815 IF posn <1:    Warn 3: STOP
820 Byte = LinkBase + PEEK_W (SysVar (link *3))
825 FOR x = 2 TO posn
830       IF PEEK_W (Byte +2) = 0: Warn 3: STOP
835       Byte = LinkBase + PEEK_W (Byte +2)
840 END FOR x
845 POKE_W SysVar (link *3 +1), Byte -LinkBase
850 END DEFine
```

Listing 9

```
900 DEFine PROCedure DeleteItem (posn, link)
905 LOCal x, Byte
910 FindPosn posn, link
915 IF posn = 1
920       POKE_W SysVar (link *3), PEEK_W (LinkBase
                    +PEEK_W (SysVar (link *3)))
925       POKE_W SysVar (link *3 +1), PEEK_W (SysVar
                    (link *3))
930    ELSE
935       Byte = LinkBase + PEEK_W (SysVar (link *3))
940       FOR x = 2 TO posn - 1
945           Byte = LinkBase + PEEK_W (Byte +2)
950       END FOR x
955       POKE_W Byte +2, PEEK_W (LinkBase +PEEK_W
                    (SysVar (link *3 +1)) +2)
960 END IF
965 END DEFine DeleteItem
```



Elements

It will be recalled that each data element consists of two bytes which reveal the length of the element, two bytes which point to the next element belonging to the same list, and finally the datum. For the purposes of the PrintAll procedure the first pair of bytes not only reveals the length of the datum but also points to the start of the next element. If this value is zero the procedure is complete and control returns to the calling module.

Where access is required to one element in particular it must be identified by a *key*. The key might be a pattern match, such as *"find all entries containing the name 'Smith'"*, or it may be a condition, such as *"find all entries which are more than 15 characters long"*. Keys may possibly be satisfied by more than one element, as the foregoing examples, or they may be exceptional, such as *"find the tenth item in the list.*

Keys may have one part, like those above, or they may have more. Listing eight finds data elements based

Listing10

```
1000 DEFine PROCedure PrintItem (chan, posn, link)
1005 LOCal Byte, x
1010 FindPosn posn, link
1015 Byte = LinkBase +PEEK_W (SysVar (link *3 +1))
1020 FOR x = 4 TO PEEK_W (Byte) -1
1025     PRINT#chan, CHR$ (PEEK (Byte +x));
1030 END FOR x
1035 PRINT#chan
1040 END DEFine PrintCurrentItem
```

on exceptional double-key formed from the list identifier and the location of the item in the list. It can be seen that either half of the key alone is not sufficient to produce an exceptional match. Giving just the list identifier will locate all items in that list, whereas giving just the list position will retrieve the *n*th element of each list in the system. Only by combining the two can a specific data element be described.

Among the three system variables forming each list header room has been found for one which can be used to point to the "current element." Listing eight uses this pointer to skip through the list until the keyed item is found. Invalid list identifiers and incorrect list positions are fully error-trapped and appropriate messages are displayed, courtesy of last month's *Harn* procedure.

Actions

The list is searched by beginning at the first element and using the information provided in its pointer to find the next element. This continues in a *FOR ...NEXT* loop until the specified list position is reached or until a zero value indicates that there are not sufficient elements in the list to fulfil the request. If the search is successful the offset of the element is placed in the "current item" pointer.

Once the position of an element has been found, various actions can be taken. The two programmed in listings nine and 10 are deletion and output. Deleting an item from a linked list involves severing the link between it and the previous element, as portrayed in figure 1. The element still exists in memory and would still be printed-out if the PrintAll procedure was used but it would cease to belong to a specific list. This is an essential characteristic of accounting programs, where mistaken entries can be eradicated from the books but must still persist in the audit trail.

It follows that a list element can be amended by "deleting" the old version and appending a new element, provided the correct links were established to put the replacement element in the proper logical position in the list. Unfortunately, frequent deletions would litter valuable RAM space with disused elements.

One cure would be to link the disused items to form a "garbage" list so that they could be recognised quickly and treated by "garbage collection" routines. They are either run at regular intervals or whenever the stored data threatens to exceed the space available. The garbage collection routine might shunt the remaining elements together, overwriting unwanted items, and then update pointers to re-establish the connections throughout the lists. Garbage management will be examined in detail later in the SuperBasic series.

Unlinking

Returning to the problem of unlinking an item from a list, it is apparent that the element must first be identified exceptionally. In this case the key is once more a combination of the list identifier and the logical position of the element. Listing nine begins by calling the *üFindPosn* procedure, which not only sets the "current element" pointer but also carries-out essential error-trapping. The first element in a list is a special case because it is pointed to by the header bytes and not by another data element. Accordingly, Listing nine divides into two sub-procedures either to modify the list header or to modify the preceding data item pointer.

Listing 10 uses the *FindPosn* procedure to print-out a single data item. Once the "current item" pointer has been set the variable *Byte* performs its usual role of identifying the first byte of the data item. Reading the contents of this word reveals the length of the datum, which is then printed to the chosen channel character by character.

To tie together the foregoing procedures and to demonstrate how they work, listing 11 is provided as a working tutorial. Type it in, enter the keyword *demo* and follow the prompts. Remember to save all the listings before attempting to test of modify them.

Linked lists form the basis of much more powerful data structures which will be featured later in this series.

Listing11

```
1100 DEFine PROCedure demo
1104 CLS: PRINT "Establish Link Area"
1108 SetLinkArea 1, 3
1112 PRINT "Adding 8 names to 2 linked lists"
1116 AddItem 'David'   TO 1
1120 AddItem 'George'  TO 1
1124 AddItem 'Alice'   TO 2
1128 AddItem 'Fred'    TO 1
1132 AddItem 'Lynn'    TO 2
1136 AddItem 'Susan'   TO 2
1140 AddItem 'Alan'    TO 1
1144 AddItem 'Wendy'   TO 2
1148 PRINT \\"These are the lists:"\
1152 PrintLink 1, 1: PRINT
1156 PrintLink 1, 2: PAUSE 100
1160 PRINT \\"This is the entire list"\: PrintAll 1
1164 PRINT \\"Enter 5 data items to form list 3:"\
1168 FOR x = 1 TO 5: INPUT " > "; a$: AddItem a$ TO 3
1172 PRINT \\"The 4th item in list 3 is:",
1176 PrintItem 1, 4, 3
1180 PRINT \\"It has been deleted"
1184 DeleteItem 4, 3: PrintLink 1, 3
1188 PRINT \\"End of Demo"
1192 END DEFine demo
```

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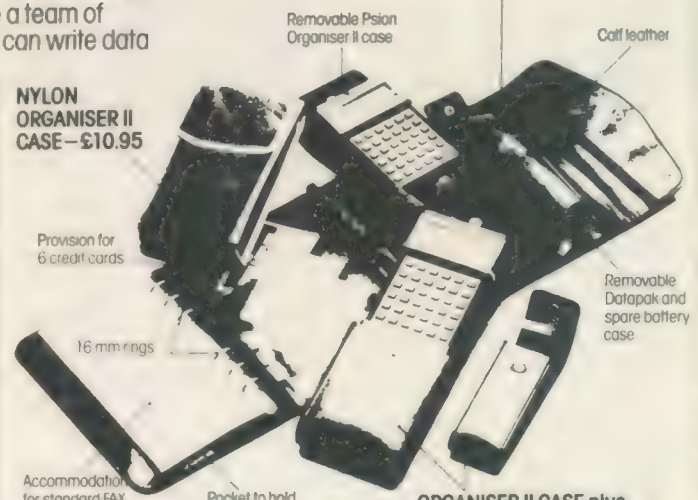

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KEY

B = Superbasic; A+O = assembler and object code; M+B = machine code and Basic loader; A+B+O = assembler and Basic loader and object code; S = supercharged; L = QLiberated; f1 = monitor mode; f2 = TV mode

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7. PACMAN by Steve Deary (B) £1
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Archive program and database for assembling and displaying large family trees. *Theory of Relativity, QL User*, July/August 1985.

9. COMPOSER by James Lucy (L) £3
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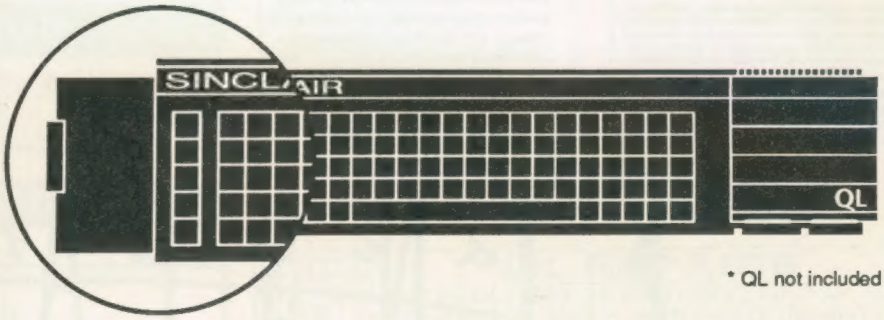

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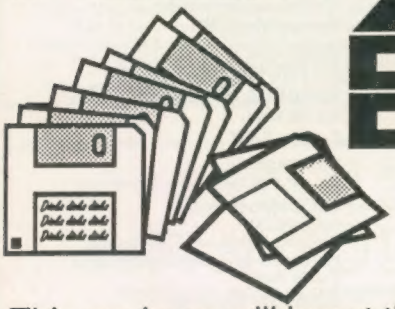

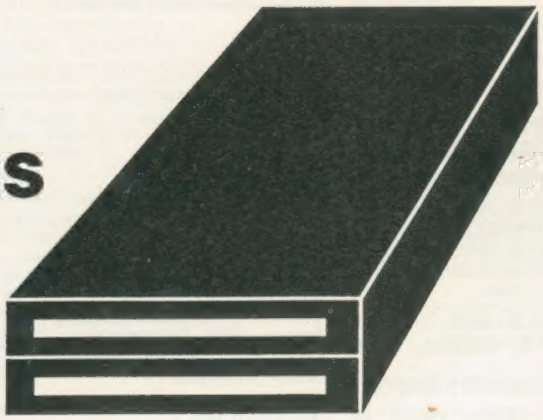

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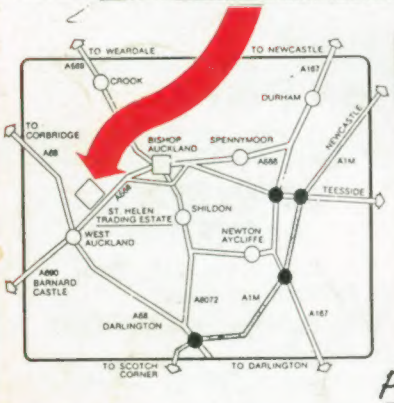

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